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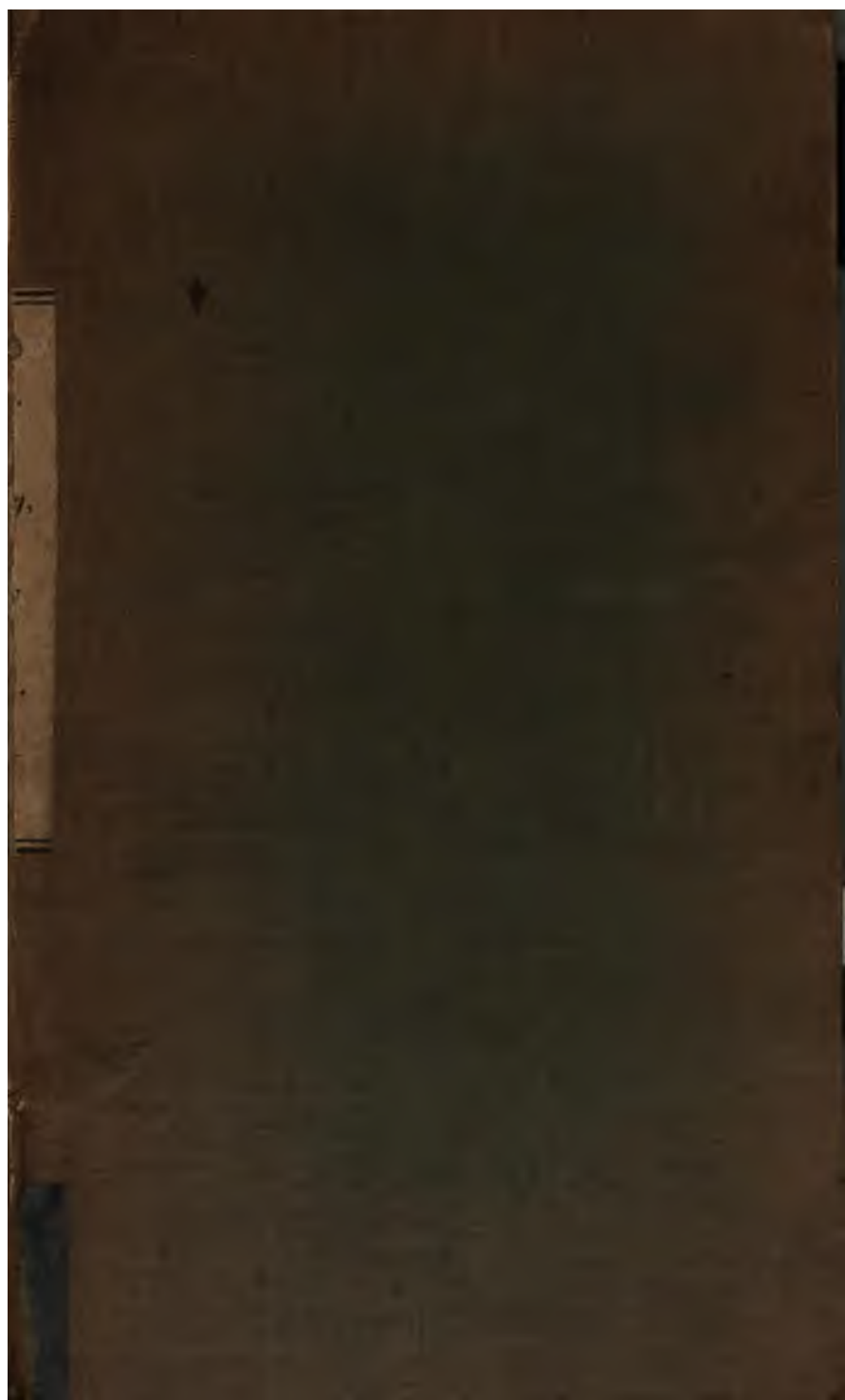
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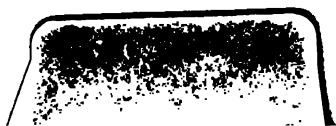
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Drawn & Engraved by S. J. Lavier

Wm Lander
Aged 68.

DAVID AND GOLIATH;

OR,

AN ATTEMPT TO PROVE

THAT THE

NEWTONIAN SYSTEM OF ASTRONOMY

IS

DIRECTLY OPPOSED TO THE SCRIPTURES,

AND, IN VERY MANY INSTANCES,

CONTRARY TO REASON AND FACT:

ALSO,

THAT THE SCRIPTURES GIVE THE TRUEST AND MOST REASON-
ABLE ACCOUNT OF ASTRONOMY: TOGETHER WITH AN HYPOTHESIS
AGREEING WITH SCRIPTURE, REASON, EXPERIENCE,
OUR SENSES, AND KNOWN FACTS, IN WHICH IS INCLUDED A
NEW METHOD OF ASCERTAINING THE SIZE AND DISTANCE OF
THE SUN, MOON, ETC.

BY

WILLIAM LANDER, SEN.
MERE, WILTS.

ILLUSTRATED BY ENGRAVINGS.



"Search the Scriptures."—JESUS CHRIST.

"If they speak not according to this word, it is because there is no light in them."—ISAIAH.

"He that is first in his own cause seemeth just; but his neighbour cometh and searcheth him."—PROVERBS xviii. 17.

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MERE :

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I think it just necessary to remark, that the Portrait affixed to this Work, is the *second* attempt at Portrait Engraving of one of my younger sons, an amateur in the art. I had at one time intended to have given a Frontispiece of David's conquest over Goliath, but by his frequent solicitations, I consented to the present.

W. L.

P R E F A C E.

CHRISTIAN READER :

To such as you I appeal, for others who oppose the scriptures, I oppose, and expect them to oppose me; but, as I conceive it to be the duty of every one who professes christianity, to contend earnestly for the faith, in every point of view, so I venture to advance the following hypothesis, for the consideration of every intelligent christian, whether it stand or fall.

Our Saviour, when speaking to his disciples, said, "That if they," (the infidels) "believe not my words, neither will they believe yours." Consequently, I expect no quarter from such men, and am well aware of the opposition I shall meet with, both from prejudice, and from those who have already imbibed the present prevailing system.

However, I have, although a very weak DAVID, ventured to throw a stone at the great GOLIATH, expecting that he will threaten to give me to be meat for the beasts of the field, and fowls of the air. I come in the same name as David of old, and hope for the same success.

By following this comparison, we may observe some similarity between the conflict of David with Goliath, and the present undertaking. David was sent to his brethren, who were in the army, with a present from his father, when the great Goliath gave his challenge, defying every man in the Israelitish army. David, seeing all the army panic-struck at the sight of the overgrown, boasting Philistine, accepts his challenge, which was to terminate according to the victory, on either side, in the servitude of that nation which lost to the other, and to be decided by single combat. David's brethren, seeing his boldness, sharply reproved him for it, and attributed it to "pride, and the naughtiness of his heart," and taunted him with neglecting the "few sheep in the wilderness," which he had the care of; but this did not prevent him from persevering in his design: full of confidence in God, he assured himself of victory, through a power superior to his own, and finally obtained it. He refused Saul's armour, and chose five smooth stones out of a brook, and with a sling and a stone, overcame the giant, and cut off his head with his own sword.

The Newtonian system of astronomy is become a giant, going up and down the world, like Goliath amidst the ranks of the armies, boasting, and challenging all opposition, whilst every one is afraid to say a word against him; and which, if they did,

they must expect to be thought quite as unfit to cope with him, as David was thought to be with Goliath.

Some may say of *me* as David's brethren said to him—"With whom hast thou left those few sheep in the wilderness?" (thy own affairs:) what have you to do with astronomy; mind your own business; what can such an one as you expect to do against so much learning and science? I reply, that this appears to me to be of more essential consequence to my own family, and the greater mass of mankind, of which, as an individual, I am a member, (taking the subject in all its bearings,) than any other kind of service I can at this time of life render them, namely, by endeavouring to remove that which I believe to be *error*, and conveying what I believe to be *truth* to their minds.

Although I may appear in the esteem of astronomers, as contemptible as David was in the eyes of Goliath; or of friends, like Saul, who may say of me, as he did to David, "thou art but a youth, and he a man of war from his youth;" yet, like him, I borrow no man's armour, but in the confidence of the truth of scripture, which is the word of God, I trust I shall succeed, and prevail over the giant, with what may appear to some to be no more than a stone.

But my principal desire is to reconcile the opponents, that in future there may be no more conten-

tion between the scriptures and astronomy; and that the *word* of God, and the *works* of God, may agree together, as they most certainly will, if rightly understood.

If I have erred, I wish to be convinced of it fairly; but whatever militates against scripture in any way, I cannot, and will not allow.

I cannot expect more favor than St. Paul met with at Athens, for the cause of truth, among the philosophers of his day. Some said, "What will this babbler say? Some reported that he was setting forth strange gods; and others mocked him. Such treatment I expect: but we are not to "follow the *multitude* to do evil," but rather are requested to "prove all things, and *hold fast* that which is good." Whoever resists the general opinion concerning any thing, however wrong, and his own cause be ever so good, must expect to be deemed a fool, or a madman. So it was with Christ himself: the Jews said, "he hath a devil and is mad: why hear ye him?"

Suppose this question were to be asked—What is truth? Would not every real christian be ready at once to acknowledge that scripture, or the word of God, was truth? If this be the case, (and it certainly is,) must not every assertion contrary to it be necessarily untrue; and if so, how are we to credit the system of astronomy, as it is now generally received, and which not only contradicts scripture,

but appears, at least to me, to contradict reason and our senses? Is it not very desirable then, that an hypothesis be found that will reconcile astronomy with them, and answer all the problems and propositions that may be urged against it: for if it can be found to be grounded on scripture, reason, and our senses, it must, in my opinion, infallibly out-weigh the other. Now such a thing appears to me to be very possible, for the following reasons, which will vindicate the truth of the scriptures.—“Let *God* be *true*, and every *man* a *liar*.”—Romans iii. 4.

If the sun be considered as moving round the earth, from east to west, (with us,) continually making a spiral motion, that is, like a screw, gradually passing from one pole to the other, alternately, every half year, still winding from one extremity of the globe to the other, till it comes to that point which we call the height of summer, or the depth of winter, or the longest and shortest day, and then recedes toward the other pole, continually preserving its circular motion round the earth, from east to west, it will produce the same effect, in all respects, as the earth's moving round the sun. This I have satisfactorily proved, by a model which I have made, and have in my possession; which also accounts for the seasons in every part of the globe, the length and shortness of the days, the variation of the sun and moon in their courses round the earth,

the moon's age, months of the year, days of the week and hours of the day, the nature of eclipses, and so on, in such a simple manner, that almost any one may comprehend it. I have also a model which shews the reasonable distances of the planets, in such an order that they cannot interfere with each other in their respective motions, and as they appear to us in their orbits as they move in the heavens.

The objection that some astronomers have to the idea of the sun going round the earth is, because they think a body must necessarily move round another body exactly over its centre, as a fixed law in nature, which the sun does not. But there is no foundation for such an opinion, as is proved by the moon, and as this objection is already answered by supposing the foregoing motion of the sun. Another objection arises from the greatness of the sun's orbit; and great indeed it would be, if it were to move round the earth at the immense distance at which they place it; whereas, the earth, according to them, turns on its axis, and receives the light of the sun, without the sun's motion. Now I shall make it appear, that, according to my ideas, the *earth* will have to travel a far greater distance in the course of the year, according to their hypothesis, than the *sun* itself will, according to mine, and yet answer the same end, that is, enlighten and warm the earth.

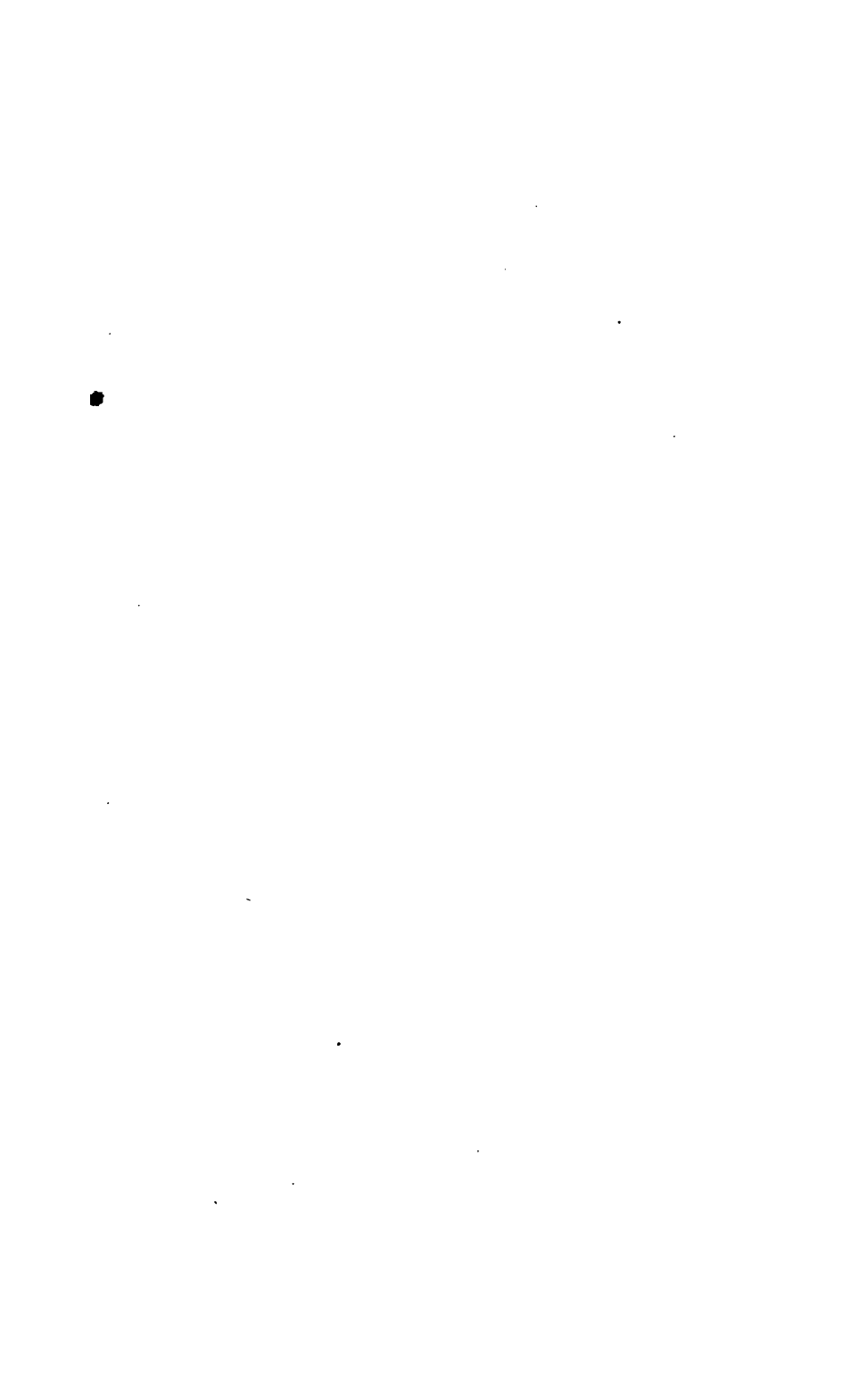
Give this book a close and candid examination, according with scripture, reason, our senses, and known facts; and then, put what construction you please upon it.

My aim is to have a right understanding in all things; but whether I succeed or not, the following pages will eventually shew.

I am well aware that the following work presents itself to the public under numerous disadvantages, and at a time when it is not to be expected that it can gain much attention. So important, however, are the questions discussed in it, that if, amidst many imperfections, it possesses any merit, it cannot be unseasonable, but may, probably, find some who will give it a candid and careful perusal.

MERE.

WM. LANDER.



DAVID AND GOLIATH.



CHAPTER I.

May that blest Spirit which at first did brood
Upon the humid chaos of this world,
And hatch'd it into order, and to life,
Now brood upon the chaos of my mind,
And regulate its efforts to obtain
Such useful knowledge from his holy word,
As worldly wisdom never yet attain'd.
"Let there be light," 'twas said;
And there was light.
O let the light of truth but on us shine,
That we may see things as they truly are;
Not as they seem to be.—Here we may err;
But taught by truth itself, we must be safe.

The motives and design of the work.

As christians, acknowledging the Bible to be truth, and a rule of faith, and a belief of its contents to be so very important to us, both here and hereafter, to be consistent, I conceive, we should reduce to that standard all that we possibly can, as it is revealed truth; for unless it were such, it would be impossible for us to know many things contained in it; and therefore it must be superior to any natural knowledge, however excellent. On this

ground I take my standing, and for this, and other reasons, I oppose the doctrines of the present system of astronomy, as generally received, and universally taught.

To reconcile astronomy, therefore, with scripture, is my principal object, more than to cavil with any other persons' opinions; as I believe the nearer we bring any system to the scriptures, of which they treat, or even hint at, the more likely we are to be correct in our judgment, for "we are but of yesterday, and know nothing," comparatively.

The writer would be happy, should he be able to throw sufficient light on this subject to convince others of the reasonableness of another system, according better with the word of God, and answering, he believes, every purpose connected with the prevailing system, if carried to a greater degree of perfection, by better heads and hands, (as he only pretends to an outline,) upon scriptural principles, and agreeing with reason, as well as our senses. Others who have more skill and leisure, should they approve of the ideas advanced, have sufficient matter to work upon, to bring these observations to more perfection. This, with a desire to vindicate the word of God, is the principal object of the writer, as it will tend to shew the consistency or inconsistency, of these very different systems.

CHAPTER II.

Thy word, all-wise and ever gracious God!
Is like thyself, and works—inscrutable.
We know a part, and but a part we know;
But blessed be thy name, that part's enough
For us to know while here.
If blessed by thy Spirit's influence,
'Twill lead to heaven, where we shall know
Ev'n as we're known

The necessity of receiving scripture as truth, and whatever we are therein informed of, although we might not fully comprehend it.

IF the scriptures were not designed to teach us astronomy, yet, upon a close examination, we perceive that they have more connexion with it than many are aware of; and very frequently refer to it in some way or other. They treat of the sun, moon, and stars—their maker—his design in creating them, and the time of their dissolution: which we could not have possibly known by the art of all the astronomers that ever existed, had we not been informed of it by holy writ.

This superior knowledge surely should be regarded; and if regarded as truth, can we entertain contrary opinions to it, and still be consistent? If we suspect the bible to be in any respect erroneous,

we do not then believe it cordially ; and are so far infidels. If it be a mixture of *truth* and *error*, who is wise enough to separate them. We are therefore under the absolute necessity of receiving it as the *pure word of God* ; or, (awful to think,) to disregard it altogether. And then what have we to rely upon ? Mens' opinions only, which are as various as their faces, and as changeable as the wind ; and which leave us altogether in darkness in regard to our most material concerns. It is true the scriptures are in many places difficult to be understood ; and hence arise so many different opinions : but this is not always the case ; as they are equally plain in the most essential parts. Were they all plain and easy, how should we account for its superiority. If all difficult, how should we be able to understand them. So far as regards the sun, moon, and stars, they appear to me as very easy and simple ; which I intend to show in the succeeding pages.

CHAPTER III.

Without the help of God's sure guiding word,
How must we stray from truth!
What can we know of things which are abstruse,
And wisely hid by him from prying eyes
Which boldly would obtrude upon those things
That should hide pride from man,
Lest he should boast of knowledge, when, alas!
He does not know himself.

The preposterous ideas of some who have written on the subject of astronomy; together with their discordance with scripture.

MANY very grand, but unreasonable ideas have been suggested by various writers of eminence, concerning the heavenly bodies; such as the opinion of Doctor Young,* who supposes that there were stars beginning to shine at the creation of the world, but owing to their immense distance from us, and notwithstanding light travels at such a rapid rate as it is said to do, (191,919 miles every second of time,) their light has not yet reached us.

One tells us that the sun is a million times larger than the earth. Another, that one of the fixed stars is 366 thousand times larger than the sun; and 38,777,783,575,000 miles distant.† Is it not strange

* Blair's Universal Preceptor, page 90.

† Mechanics' Magazine, 1829.

that they can measure such an immense distance so extremely accurate. And again, is it not equally strange, that our sight will reach to such an immense number of miles *upwards*, when we could not see to a quarter the number of barley corns distance, on a *level* with the earth.

Whiston supposed the sun to be hell, as he believed it to be fixed in the centre of the universe; and sufficiently large to contain the lost sons and daughters of Adam.

Some suppose the moon to be inhabited; and that this earth is as a moon to them. But there must be a great disproportion, if the moon, as they say, is sixty times smaller than our earth; then, a moon sixty times smaller than our moon would be sufficiently large for it in proportion: Whereas, if our earth was to be a moon to the moon, it would be sixty times too large for it. Here appears an inconsistency.

We are told of stones thrown from volcanoes in the moon; supposed to reach us in about three days from the beginning of the fall. Yet, with all the accelerated motion which they must necessarily acquire in falling, they are found to penetrate only about a foot or two into the earth. This is very extraordinary. I should suppose, that falling with such amazing swiftness, they would be buried so deeply as never to be found. Would it not be more

reasonable to suppose that they came from volcanoes on the earth, which we know discharge stones with amazing force.

We not only hear of volcanoes in the moon, but of caverns and pits ; which some have contrived to measure : and they tell us that some of these pits are four miles deep ; the mountains five miles high ; with their names, and so on. In short, we are favored with a kind of geographical description of its various parts. Now this appears as fanciful as the story of Bishop Wilkins, who, when talking to a lady about the practicability of making a journey to the moon, was asked by her, where he intended calling, in case he should need refreshment. He replied, there would be plenty of places, since her ladyship had already built so many castles in the air. But he seems favorable to the idea of erecting a few *under water*, in his "Mathematical Magic," Chap. 5, where he advocates the plan of sailing ships under the surface, to avoid storms at sea.

We are told that the moon performs its revolution round the earth, once in a month ; but it appears to our senses to go round nearly once a day. If we see it at any given place in the heavens, on an evening, at a certain time, it will be nearly an hour later the next evening, when we see it there again. Modern astronomers say the earth moves from west to east, to receive the light of the sun, and that we pass round exactly in twenty-four hours, and con-

sequently meet the moon, in our progress an hour later every night; and so on to the end of the month.

Here are contrary causes producing the same effect. Here, the moon appears to go from west to east, as well as the earth, only slower: if so, it is contrary to its appearance to our senses. So that by the motion of the earth, every other thing seems to us to be turned upside down, or, at least, to turn a contrary way to what our senses indicate.

They also assert, that the sun is fixed in the centre of the universe, and only revolves on its own axis; but David, who was a king, and a *prophet*, who *considered* the heavens, tells us, in the nineteenth psalm, that, "In them hath he" [God] "set a tabernacle for the sun, which is as a bridegroom, coming out of his chamber; and rejoiceth as a strong man, to *run a race*. His going forth, is from the end of the heaven, and his circuit unto the ends of it."

They say also, that the earth, in addition to its diurnal motion, makes a circuit round the sun every year. But David says, in the ninety-third psalm, "the world is established, that it cannot be moved." And again, in the 104th, he says, "who" (meaning God) "hath laid the foundations of the earth, that it should *not be moved for ever*." There are many other passages to the same effect, as will appear as we proceed. How can we account for the motion of a body that is pressed equally on all sides, as the earth is, on natural principles, unless it be

like a ball carried in the hand. And where is that hand? Here we are lost. Why not, then, adhere to scriptural revelation, which, in a sense, is God's account of it, and if so, must be correct, whether we are so or not.

The Rev. Alexander Catcott of Bristol, remarks, in a work which he published, that Sir Isaac Newton professed to account for the annual motion of the earth, but not for the diurnal. That is, says Mr. Catcott, as if a man could count the hours in a year, but not the hours in a day.

One writer says, that the earth, by its motion round the sun, of 68,000 miles an hour, and its motion round its axis, of 1000 miles an hour, causes all its parts to incline towards the centre.* But this reasoning is not satisfactory, as it is contrary to experience. In all other things, that may be compared to it, which I know of, such motions have a contrary effect; for instead of being centripetal, it would, in my opinion, be centrifugal: that is, more inclined to throw *from* the centre, than tend *toward* it. The reader may, perhaps, think my comparison low, but this signifies nothing, so that it conveys the idea. Suppose a wet mop were to be turned swiftly round by the handle, (let the mop represent the earth, and the handle the poles,) and it will have the same motion which we are told the earth has, and by its motion, the water, and every loose part, will im-

* Wonders of Nature and Art.

mediately begin to fly off from the centre, in all directions, upwards, as well as downwards. It is vain to attempt to account for the works of the Almighty, on natural principles; for "we know but in part."

We often hear of spots on the sun, of which, a very particular account was given in the St. James's Chronicle for July 1st to 3rd, 1830. It says, that on "Wednesday morning at 8 o'clock, the largest spot which has been seen on the sun for many years, was observed by William Shires, the mathematical tutor; its diameter subtended an angle of 57 seconds of a degree, and therefore, taking the sun's diameter at 800,000 miles, it extended 23,750 miles in length, and being nearly circular, covered 443,000,000 square miles of the sun's surface."

In the above computation of the sun's diameter, we have only 800,000 miles; whereas, others compute its diameter at 900,000 miles. Here observe how well astronomers *agree* in their measurements: in this case there is a difference of 100,000 miles in their calculations: not a very trifling incongruity, certainly. But this I shall treat of more particularly hereafter.

A great deal has lately been said about these spots, which I have tried to discover, but have hitherto failed: I do not *deny* that there are such; I only suspect it; as I think they may arise from deception; perhaps in the eye itself, which sometimes has spots floating in the fluid part of it, obstructing the

vision, and representing those spots on the object, as though they were actually there. (That this is sometimes the case, I know from experience.) The eye will often see an appearance of a spot by looking intensely at the sun. Or it may arise from dust, or some other imperfection in the telescope; or from some opaque body with which we are unacquainted, passing between us and the sun, like a transit of Venus, which appears as a spot on its surface. If there really are such spots on the sun, and the sun, as we are told, turns on its axis, it must either turn fast or slow; if fast, they might be seen oftener; if slow, they would remain longer to be seen: but it seems they are only seen casually. Suppose it to be the case, unless it were so from the beginning, (which we have no reason to believe, or it might, probably, have been seen long ago,) have we not great reason to fear that the darkness which our Saviour foretold, (Matthew 24th, 29th,) is already begun; and the "great and dreadful day of the Lord" approaching. Malachi, 4. 5.

We are told that the sun is nearer to us in winter, than in summer. This seems rather paradoxical to me, and appears contrary to reason. The reason alleged is, that the sun appears larger then, than in summer, and therefore must be nearer, because all objects apparently increase, or diminish, according to their distance. The reasoning is good, but the premises I conceive to be false; for on the same principle, we may infer, that the

moon, when it rises, is nearer the earth by as much as it appears larger, than it is when risen to its meridian; for when rising, it appears nearly twice as large as it does at the meridian. It is allowed by all, that the atmosphere is more dense near the surface of the earth, and gradually thinning upwards. It is evident, then, that viewing the moon through a dense medium, magnifies it, and is the cause of its appearing larger. Now if we apply it to the sun, do we not see it under the same circumstances in winter? In consequence of the sun being lower in this season of the year than in summer, there is a much greater quantity of dense air between it and us, which sufficiently accounts for its appearing larger, notwithstanding its greater distance. In this case it appears just as letters appear through a magnifying glass, which being thicker in the middle, makes them appear larger; but when the glass is of an even substance, the letters appear of their proper size; and if the glass be thinner in the middle, than at the edge, they will appear smaller.

Those who say the sun is nearer to us in winter, than in summer, because it appears larger, do not seem to be aware, that it is as much as to say, there is no heat in it, for it is certain, the nearer we are to a body of heat, the more we must feel its effects; and if so, it would be warmer in winter, than in summer; which is contrary to reason and experience. But if, (as I shall endeavour to prove,) the sun goes round the earth, and by a gradual spiral mo-

tion approaches toward us from the south; by that means a greater part of its orbit passes over us, conveying light, and heat, by its longer stay, its rays falling more perpendicularly upon us than in winter, and the coldness of the night being of shorter duration, causes summer, naturally and rationally. (See Plate 2, Fig. 1.) Again, when the sun recedes from us, toward the south, and its rays take an inclined direction to us, compassing the earth at a greater distance from us, there is a much shorter part of its passage through its orbit exposed to us: this, with the absence of the heat, and, as a matter of course, the increased length of the nights, their coldness increasing with their length, produces winter; the sun, not only shining a shorter time, but its rays falling more obliquely. I shall here merely remark, that as the sun approaches toward us, from the south, it passes over the equinoctial line, and produces a summer to that part of the earth; and as it recedes from us, another: so that those at the equinox, have two summers in one year, and we only one.

If the reader finds any difficulty in comprehending what I mean by the winding motion of the sun, let him make a circular motion before him with one of his hands, and continue it while he walks backward and forward a few times, and he will make exactly the motion with his hand that I mean.*

* To represent the motion of the sun, let the ~~walking~~-be from north to south, and from south to north, and the motion of the hand from east to west.

CHAPTER IV.

What! not one world content thee, atom,
But thou must create more; yes, world on world,
In thy imagination? Where's thy warrant?
And canst thou prove it from the word of truth?
Must we believe because *thou* sayest it,
Without a greater proof?
Make good thy other sayings; then we may
Afford thee credit, such as thou deserv'st:
But know, the *word of God* says no such thing;
And this we credit far beyond thy word.
Consider this *one* well, and thou wilt want
No other *earthly* world; but only heaven.

*An endeavour to prove the futility of many worlds; and,
also, that the whole planetary system was designed for
this earth alone.*

Some persons seem very fond of the idea of many worlds, enlightened by many suns; and system upon system, in the immensity of space. This is certainly a very exalted idea, but as we have no authority from scripture, to assert this, it can be no more than conjecture. But even this supposition can add nothing to the glory of the Almighty; for that power which could speak such a system as we behold, into existence, could certainly create more if he pleased. It as much requires an Almighty power to create an

insect, as it does to create an elephant. But when we give way to conjecture, where may not our fancy lead us.

If we examine this opinion of various worlds and systems by the scriptures, and their general tendency, we can find but little reason to entertain such an idea; neither should we regard what men say, when they tell us that the planetary system is so very great, that if this earth was annihilated, it would not be observed, by an eye, that could with one view survey the whole. Suppose this was true, yet is not the earth of more real value than all the rest. They are not intelligent, however glorious they may be, in appearance to us. We believe them to be nothing more than inanimate matter, or substance, of a wonderful form and quality, incomprehensible to us, and evidently shewing a most glorious display of the inconceivable power and goodness of God. But with all their extraordinary qualities, they fall infinitely short of the souls of men, in point of value, one of which, out-weighs them all.

When we consider for what this world was made; that it was to be the habitation of men—intelligent beings, endued with contemplative minds—capable of admiring these astonishing proofs of almighty power and benignity, and adoring their maker and preserver, the whole planetary system sinks into comparative insignificance. Not only this, but the

souls of men are of *eternal* duration; whereas, the planetary system is not; for we read, that *it* shall have an end.

When these orbs were created, God said, "let them *be* ; and it was so : " but when man was created, it is said, "let us *make* man ;"—" and God breathed into his nostrils the breath of life, and man became a living soul." There was, then, a remarkable difference in the manner of their creation ; but much more in the design for which they were made. Admitting this, it will follow, that all these things were designed for man, as he could not possibly exist without them ; neither, indeed, did man begin to exist, until all these were created for him.

We all well know what the consequences would be, if the sun or moon were to be extinguished, or annihilated. There would be no light, heat, or vegetation. The water would become ice—our blood freeze in our veins—the sea stagnate—its inhabitants die—and in fine, the world would be at an end, as it regards man. Therefore, it is very evident, that these things were all created for the good of mankind, and are to continue until the race of man shall end.

We read, that at the last day, when all temporal things shall be brought to an end, having finished the design of their almighty and all-wise creator, "the sun shall be turned into darkness, and the moon into blood," (that is, its light shall be extinguished,)

“the stars shall fall from heaven, the heavens shall pass away with a great noise, and the elements shall melt with fervent heat,” being of no further use.

If we still doubt the superiority of mankind to the planetary system, let us consider what the scriptures say. Recollect what Christ has done for mankind. Has he not taken our nature upon him, and ascended to heaven *in that nature*? Does not this stamp a dignity on man far superior to all the wonders we see around us? If God gave his son to suffer, bleed, and die for us, will he not also “with him, freely give us all things?” Yes; for Paul, addressing himself to the Corinthians, says:—“All things are yours; and ye are Christ’s; and Christ is God’s.” Christ gave his *life* for us, and the work of his hands cannot be regarded as a greater boon. That all things were created by him we know from the authority of scripture: it says, that “without him was not any thing made, that was made;” John i. 3,: and again, “he that built all things is God,” Heb. iii. 4. Can we reasonably believe that there are more worlds than this, after considering these things? Has not this world, with its concomitants, been sufficient to fill our minds with awe and wonder, connected with the death of its maker—the salvation and glorification, or eternal destruction of the human race? Contrast the value of the planetary system with the following scripture, and the inferiority of that system will

readily appear—"Unto *us* a child is born, to *us* a son is given; and the government shall be upon his shoulders, and his name shall be called Wonderful, Counsellor, the *mighty* God, the Everlasting Father, the Prince of Peace." Isaiah ix. 6.

Think on the glorification of his saints. And who are saints, but the sanctified of mankind; "For as many as are led by the spirit of God, they are the sons of God:" "They shall be made kings and priests unto God," Rev. i. 6., "and they shall reign with him for ever." Rev. xxii. 5. And "when Christ who is our life shall appear, then shall you also appear with him in glory." Col. iii. 4. "Do ye not know that the saints shall judge the world; and if the world shall be judged by you, are ye unworthy to judge of the smallest matters?" 1 Cor. vi. 2. For "we know when He shall appear, we shall be like him, for we shall see him as he is." 3 John iii. 2. Now what are the planets, however large or distant, when contrasted with the inexpressible glory and exaltation of the elect inhabitants of this world? When this world ends, these planets will also cease to exist.

Sir Isaac Newton (as I have been told) was so puzzled, when, entertaining so mean an opinion of the earth, he compared it to the sun, (which he estimated at a million times larger,) and the rest of his enormous planets, that he did not know what to

think of the doctrines of christianity—that the Son of God—the Creator of the universe did actually die for the sins of mankind. I do not wonder at his incredulity, taking into consideration his ideas respecting the planets; but such notions as these naturally incline to *deism*. When gazing at, and considering these *magnified* objects, persons are apt to lose sight of the Bible, and by magnifying the *works* of God, set too light a value on his *word*.

Are the inhabitants of these imaginary worlds sinners? if so, were they redeemed as we have been? for if they have neither sinned, nor been redeemed, ours must necessarily be the *only sinful* world in the whole immensity of space; and by this comparison we certainly appear the *more sinful*.

If we go beyond revealed truth, we are lost; therefore we should never attempt to be “wise above what is written;” for if we do, “in attempting to be wise, we become fools.”

There are numbers of things, even within common observation, past our comprehension, the cause or progress of which, it is impossible for any person to define. If this be the case, (and most assuredly it is,) how can we expect to form correct ideas of things so remote as these imaginary worlds are supposed to be, and of which it is impossible we can be acquainted, unless it had pleased God to communicate it to us, as he has other things, of

which we should have been equally ignorant without such information ?

The great Creator's glorious works around
 Are proofs of kindness, and of love to man :
 Are evidences of his power and wisdom ;
 And silently persuade us to adore
 That goodness which has formed them for us
 His sinful creatures.
 We seldom view his works but with indifference :
 And like the brutes that gather up the acorns,
 And look not at the tree from whence they came ;
 (Or should they look, they cannot comprehend ;
 Nor can they scan the tree that gives them food ;)
 So man with all his nat'ral powers is limited,
 Or he would scale the heavens ;
 And his presumption
 Would urge its way, if possible,
 Unto the throne of God itself.
 Let us be humble, willing to be taught
 And guided by his word ; which far outshines
 The planetary system,
 However glorious :
 The splendours there, when rightly understood,
 Are greater far than they.
 Compare the natural sun, to that bright sun,
 The sun of righteousness ; God's only son ;
 Its lustre's lost ! it is eclips'd at once !
 And hides its face with shame !
 What are the planets when compared with those
 Bright ministers who preach his sacred word,
 And many turn to righteousness,
 Diffusing sacred, borrow'd, light, like planets,
 Unto the world at large.
 And brighter will they shine hereafter
 Than any stars ; *that*, they are promised ;
 And when all other stars shall fall from heav'n
 They shall enjoy it.
 The stars innumerable compare with saints,
 And all their twinkling glory's light as air,
 When put into the scale of sterling worth :
 A number, they, which none can ascertain ;
 Of every nation, people, ev'ry tongue :
 The word of God declares it.—Let that word
 In our affections have the highest place,
 That all our thoughts may bend to it,
 Not *to them* :
 For like the throne of heaven 'tis fix'd unalterable.
 Nor eye hath seen,
 Tho' it has seen so much ;
 Nor hath the ear e'er heard,
 Tho' it has heard much more ;
 Nor heart conceived—for it exceeds them all,
 What God has still in store
 For them that love him.

CHAPTER V.

When David slew Goliath, did his friends
 Leave all the battle to him? Did they not
 Complete the victory that he begun?—
 Finish the conquest, and overcome
 Their enemies and gods?
 So then, let friends of scripture-truth,
 Contend as earnestly for truth;—
 The truth of God; and they shall overcome.

*On the necessity of following up these ideas, if approved,
 in order to complete the system; together with an hy-
 pothesis attempting to reconcile Astronomy with Scrip-
 ture, our senses, reason, experience, and facts.*

IF what I advance should meet the approbation of any of the admirers of scriptural-truth, (which ought to have the pre-eminence with professing christians,) and those who may be competent to the task, will kindly lend a helping hand, I believe it may be made to bear equally well, and produce a more natural, scriptural, and reasonable system, and much more easily comprehended than that which we are now taught to believe.

The Israelites followed up David's victory, drove the Philistines off the field, and pursued them until they came to the valley and gates of Ekron; and should not brethren, who espouse and contend

for the veracity of scripture, unite in upholding it in this age of infidelity and contradictory opinions. Not that it needs *our* aid; for it is quite sufficient of itself to support itself against all the opposition either earth or hell can make to undermine it: but it is our greatest honor to be on its side, whatever ridicule or opprobrium we may incur. We should esteem it an honor to "come to the help of the Lord, against the mighty."

I do not profess to be an astronomer; I only wish that astronomers would examine the hints and observations that I have made, (many of which have never before appeared in print, to my knowledge, and are not borrowed from any person,) and endeavour to reconcile the system, in a complete form, with the scripture, as well as to answer every thing that may be required; that astronomy and scripture may go hand-in-hand, and, that in future there may not be so much apparent contradiction. "In the multitude of counsellors there is safety."

As astronomers do not agree in their calculations, the hints and observations that I have advanced in this small treatise, may be a good rule by which to establish a system, whereby astronomy and scripture may corroborate each other, and be a means of removing many persons' doubts respecting it; especially as they are in their consequences to us, so blended together, both for our being, and well-being, as I intend to prove in the sequel.

In such matters as cannot be fully ascertained by observation, it is safer to judge by revelation; although not quite so explicit as we might desire it to be on the subject. Else must the scriptures be made to accommodate every man's fancy?—Or, are we to read them, as it were, backwards, as some have said witches say the Lord's prayer; for the scriptures assert one thing, and astronomers another. Let them tell us how this globe, which we inhabit, is supported in the atmosphere, by *natural* means, although pressed on all parts by the atmosphere, equal to fourteen or fifteen pounds upon every square inch of its surface, and notwithstanding a square inch of its ponderous contents, tapering from its surface to the centre, is so much heavier, which I shall shew more particularly hereafter. Is it attraction? Is it gravity? Or what else, but the infinite wisdom and power of the creator, which sustains it, in a way unknown to us. Doctor Watts says :—

“Upon the empty air,
The Earth was ballanc'd well;”

I will add—

But by what nat'ral means
No mortal tongue can tell.

“The works of God are inscrutable; and his ways past finding out.”

Let these wiser men explain to us the growth of a hair of their heads; or, how the mind acts upon

the body so as to bend a finger ; or a thousand other things which might be named, and with which they are daily conversant, before they tell us so much about attraction, repulsion, centrifugal, and centripetal force, and what not, as connected with the planetary system, which they cannot fairly prove. I would ask, if one body attracted another, at a distance, would not that attracting power *increase* as the distance between these bodies *decreased*, until they were united, unless prevented by some intervening body ? And what is attraction ? We know what is meant by the word, but what the innate properties of attraction are, we cannot comprehend. Who can account for the properties of magnetism—for the inclination of the magnetic needle to the north, and its dipping, but by supposition ? It seems almost like animation ; but we know it is not. One philosopher acknowledged that he expected to leave the world before he should be able to account for the spinning of a top ; yet some pretend to account for the motion of the celestial bodies, at the distance (as they say) of 38,777,783,575,000 miles ! If they cannot explain how a finger is moved, nor account for the spinning of a top, how can they explain the cause of the motions in the heavens ?

I shall now proceed to shew the basis, or principles, on which I build the following hypothesis. And the first principle I shall lay down, is, what I suppose most people will allow ; namely, that

we cannot see the sun till it rises above our horizon; and if so, it must have the same effect in every part of the earth.

Secondly—If we divide the earth, and heavens, in our imagination (or draw it on paper) into twenty-four equal parts, facing the south, to represent the twenty-four hours, the sun in its course, must cut, or pass these lines uniformly, to appear as we see it.

Thirdly—If we describe a quarter of a circle, or quadrant, and draw a perpendicular line from the centre, (the quadrant, or quarter of the circle being towards the left hand,) and an horizontal line at the bottom, at right angles with the perpendicular line, including the quarter of the circle, (which represents the earth,) another horizontal line, drawn from the upper part of the circle, parallel with the under line, will represent an horizon. (See Plate 3.) Fix the foot of the compass in the centre, and describe another quadrant, at four times the distance of the first quadrant from the centre; divide it into six equal parts and draw lines to the centre: The lowest of these lines answers for six o'clock, and the perpendicular line for twelve o'clock. The next above the horizontal line, or seven o'clock line, will cut the horizon of the earth at three semi-diameters distance from its surface, or four from its centre. Hence, I conclude, that that is the true distance of the sun, to agree with time, and the view we have of it in its

daily course, as will hereafter be more fully explained.

Fourthly—That the scriptures must be regarded by us, rather than mens' opinions, in order to render us consistent christians; and if so, then we must consider the sun and moon to be the *greater* lights, or we cannot receive the words according to their common and obvious meaning.

Fifthly—That the sun goes round the earth, making a spiral motion, like the threads of a screw, from north to south, after the rate of half its diameter each day, beginning at the longest day in summer, and receding towards the south till it reaches the extremity of its course southward, which is the shortest day; and then returns towards the north, in this, its constant course, the earth being immoveable; so that as the sun recedes from either pole, in the same proportion does the length of the days decrease at that pole, and at the same time, and in the same degree, the length of the days increase at the opposite pole.

According to views of astronomy, the pole stars are, in a certain sense, as the centre of motion for all the planetary system; and the course of the constellation, called the Bear, or Charles's Wain, in passing round the north star, very well represents the sun, going round the earth; as it passes from east to west in the upper part of its orb, and in the under part, from west to east, as the sun does.

And as its orb clears our horizon, that is, the under part of its orb being a little above it, it will explain the retrograde motion of the stars; because it goes both ways in going round the circle; and as it ascends, or descends, it can have no motion either east, or west, but appears in this respect, as though it stood still. And so it must naturally be with all the stars.

Some are inclined to think that the stars are of little, or no use to us, as belonging to our system; and, therefore, are led to imagine that there are more worlds, and more systems. But we read "they fought from heaven; the stars in their courses fought against Sisera." Judges v. 20. And again, Genesis i. 16, 17, 18, "And God made two great lights: the greater light to rule the day, and the lesser light to rule the night: he made the *stars* also. And God set them in the firmament of the heaven, to give light upon the earth, and to *rule* over the day, and over the night, and to divide the light from darkness." See also Job xxxviii. 31, 32, and 33; also Jer. xxxi. 35. Nothing is created in vain. The bountiful Creator has given us senses to enjoy his other gifts, and to admire his works: And does he not gratify these senses in innumerable instances? "The firmament sheweth forth his handy work;" and it is a truly beautiful sight for a contemplative mind, on a clear evening to observe the brilliancy of the stars, and the delightful blue sky.

We may also ask, of what *use* are the many beautiful flowers that bespangle the earth, with their various hues? Do they not afford us delight, and at the same time adorn the earth? Let us look for a moment at the delicacy and symmetry of their structure, and can we help admiring the amazing skill of the allwise artist, which sets at defiance all the art of man! We cannot even comprehend, fully, much less make any part of, any one thing which God has made: not a grain of sand, or the smallest particle of dust. How dare we, then, be so presumptuous, as to pretend to account for his greater works, in any other way than that in which he has revealed them to us in his holy word, when the wisest of us cannot even comprehend how a blade of grass extends its length and size, as it grows, so as to define or explain it.

The blooming flow'r that's form'd with so much art,
Will to the mind convincing proof impart,
That none but power divine and wisdom join'd
Could make, or comprehend, or method find
To amass such wonders in so small a space;
Such beauty, elegance, perfume, and grace.
The wisest man has never yet explain'd,
By *nat'ral* means, how this is all attain'd:
{ The work is God's, and if we do but touch
 Their delicate and tender frame, 'tis such,
 So much like moths, e'en that would be too much.
By handling it, we, like the ruthless storm,
Derange its parts, and spoil its beauteous form.

Of what *use* is the rich plumage of birds, and their warbling notes to us, or to them? Is it not to give us pleasure? All creatures have their peculiar beauty, and some are exceedingly ornamented; which shews

the profusion of kindness and love of the benign Creator towards us, and his other creatures. "For, his pleasure they are, and were created." If we were entirely deprived of those things which appear, to some, to be of very little use, we should soon indeed find this "earth a tiresome place." We have abundant reason to exclaim with St. Paul, (though on a nobler subject,) "O, the depth of the riches, both of the wisdom and knowledge of God; how unsearchable are his judgments, and his ways past finding out." Rom. xi. 31.

I shall now advance five arguments in favour of the motion of the sun round the earth: the *First* of which is from scripture: *Second*—From the evidence of our senses: *Third*—From experience: *Fourth*—From reason: *Fifth*—From known facts.

Who is this stripling? What does he do here?
He never join'd the ranks of armed men:
What is he? O, he's but a shepherd-boy;
What can he do against the great Goliath?
If God is with him, he can do
"All things," like Paul, and overcome a giant.
Such things as men *despise*, God often *takes*,
To mock the pride of men, whose boasting tongues
Assail the God of Heav'n, like David's foe.
God humbles, or destroys, such men as these.
Like David we should act, and trust in God:
Let Bear or Lion come, we need not fear;
Nor yet the fiercest of God's bitter foes:—
Trust in his word, and we can never fail.

In the allusion to David and Goliath, in the preface, there appears to me a kind of similarity. The armies of Israel and the Philistines are in battle array—Goliath challenges any man in Israel to fight him—he is considered overpowering—every one

is afraid to accept his challenge but the stripling David, who accepts it—refuses armour—and, it is said, “took his staff in his hand, and chose him five smooth stones out of the brook,” and with the first of these stones overcame the boasting Philistine.

Like him, I chuse five arguments; and the giant supposed before me, I put my hand into my bag for one, which is as a stone, and with which I hope to succeed, so far as to sink it into his head, and humble him before the word of the Almighty, which is the most powerful with some; yet, as some giants’ heads in our day, are even harder than Goliath’s, it may require all five to make an impression; or even more, before they will yield. And as David cut off his opponents head with his own sword, so shall I endeavour to cut off the prevailing errors respecting the giant, astronomy, both by his own sword (contradiction to truth) and by “the sword of the spirit, which is the word of God.”

Although the scriptures were not intended to teach us astronomy in particular, as some tell us, yet, I believe, that whatever subject they treat of, it is absolute truth. We read that *all scripture* is given by inspiration. “Holy men of God wrote as they were moved by the *Holy Ghost* :” and as consistent christians, we must believe them, rather than others, who are not so taught, especially when they assert any thing which appears unreasonable. All parts of the scripture that men-

tion the sun, convey naturally, as well as literally, the idea of motion to the sun, and stability to the earth; and we must of necessity, strain the words very much, to establish a contrary meaning. For example, let us take that of the "noble Bereans," who "searched the scriptures, to see if these things were so." In Joshua x. 12, 13, 14, we read, that "then spake Joshua to the Lord, in the day when the Lord delivered up the Amorites before the children of Israel, and he said in the sight of Israel, 'sun, stand thou still upon Gibeon; and thou moon, in the valley of Ajalon.' And the sun stood still, and the moon stayed until the people had avenged themselves upon their enemies. Is not this written in the book of Jasher? So the sun stood still in the midst of heaven, and hasted not to go down about a whole day. And there was no day like that before it, or after it, that the Lord hearkened unto the voice of a man: for the Lord fought for Israel." 37th v. "And it came to pass at the time of the *going down* of the sun," &c.

What can we infer from the foregoing account, if we read it without prejudice, or prepossessed opinions, but that Joshua believed the sun to be in motion, as well as the moon, when he said, "Stand thou still." Had he thought as Newton did, he would, or should have said, "earth stand thou still," to be consistent, (if the earth did move,) which would have had precisely the same effect; but it is

observable that he makes use of the same words to both sun and moon. Joshua, we know, was contemporary with Moses, who wrote the history of the creation, which he must have had immediately from God, otherwise, he could not have known any thing about it, for it was before man was created that all these things, of which he wrote, were made. If not in this way, he must have received it by tradition, from Adam, and others succeeding Adam; but even Adam himself could not have known what is recorded of the creation before he had an existence, unless it had been revealed to him; either way it must have been communicated by the allwise God, in some way, or manner, unknown to us.

Considering the subject in this point of view, is it not strange that Moses should be so ignorant, as not to know whether the sun was in motion, or fixed in the heavens, as our modern astronomers tell us it is. And is it not equally strange, that Joshua should not know, as they were both indulged with communications from God, and who were both wise, good, and great men; and both leaders of God's chosen people—far greater—and in my opinion, for the reason before stated, more wise—than Sir Isaac Newton, or any of our modern philosophers, or astronomers, notwithstanding the *rapid* "*march* of intellect."

If we refuse scriptural testimony, I think we can make but poor pretensions to christianity. For if

we prevaricate with, or wrest the scriptures, we destroy them as a standard of truth; which we must do at our peril; for we are not to add to, or diminish them; and without them what have we to rest upon, but the opinions of fallible men.

My opinion is, that the christian religion and astronomy are so blended together, that they, in a great measure, stand as evidences of each other, which, I think, as I proceed, I shall be able to prove to every considerate and intelligent mind; and I think it must be a very hard head to resist this hard argument.

We are informed in the hundred-and-fourth psalm, that "*the sun ariseth.*" And again, in Ecclesiastes i. 5., "*The sun also ariseth, and the sun goeth down, and hasteth to his place where he arose.*" Again, "*From the rising of the sun, to the going down of the same, the Lord's name is to be praised.*" Psalm cxiii. 3. "*And when the sun was up.*" Matt. xiii. 6. In Genesis xix. 23., we read, that "*the sun was risen upon the earth, when Lot entered into Zoar.*" And again, in Ephesians iv. 26., "*Let not the sun go down upon thy wrath.*" "And Isaiah the prophet cried unto the Lord, and he brought the shadow ten degrees backward, by which it had *gone down* in the dial of Ahaz."—2 Kings xx. 11. "*The heavens declare the glory of God, and the firmament sheweth forth his handy-work. Day unto day uttereth speech, and night unto night*"

sheweth knowledge. There is no speech nor language, where their voice is not heard. Their line is gone out through all the earth, and their words to the end of the world. In them hath he set a tabernacle for the sun; which is as a bridegroom coming out of his chamber, and rejoiceth as a strong man to *run a race*. His *going forth* is from the end of the heaven, and his *circuit* unto the ends of it; and there is nothing hid from the heat thereof." Psalm xix. 1, 2, 3, 4, 5, and 6. Also Psalm civ. 5. "Who laid the foundations of the earth, that it should *not be removed for ever*." It is very clear that the text just quoted, is composed of both a literal and figurative meaning, which is common in scripture: for instance, in John x. 14., our Lord speaks of himself, as "the good *shepherd*." And in Exodus xv. 3., we read, that "the Lord is a *man of war*." David in Psalm lxxxix. 11., says, "The heavens are thine, the earth also is thine: as for the world, and the fulness thereof, thou hast *founded* them." Now we do not apprehend the word "founded" to mean a *foundation*; but merely to imply that God *built*, placed, or established them. If we tamper with the scriptures, we must abide by the consequences; for the words "should not move for ever," cannot be very easily construed to mean *motion*. But here astronomers think they may cavil, because the earth, literally, has no foundation, which part they easily do away, and get

rid of, and then, by setting the earth in motion, rid themselves of the other part; so that the text, according to them, amounts to nothing. This reminds me of an old story of a man with grey hairs, and his two wives, one of which was old, and the other young. The youngest plucked the *grey* hairs from his head, to make him look *younger*; and the eldest did the same with the *brown* hairs, in order to make him appear *older*; and so, between them both, they made the poor man quite bald. But this will not avail, "for the wisdom of this world is foolishness with God, for it is written, he taketh the wise in their own craftiness; and again, the Lord knoweth the thoughts of the wise, that they are vain; therefore let no man glory in men." 1 Cor. iii. 19, 20, 21. "The foolishness of God is wiser than men; and the weakness of God is stronger than men." 1 Cor. xxv. "God hath chosen the *foolish* things of this world to confound the *wise*, and God hath chosen the weak things of the world to confound the things which are mighty; and base things of the world, and things which are despised, hath God chosen, yea, and things which are not, to bring to nought things that are; that no flesh should glory in his presence." 1 Cor. xxvii. 28, 29.

"Blind unbelief is sure to err,
And scan his work in vain;
God is his own interpreter,
And he will make it plain."—COWPER.

And dare we trifle with the word of God!
 Which ascertains our pardon, or our doom!
 Think on a criminal condemn'd to die!
 And execution soon to be enforc'd!
 He sues for pardon; but his anxious mind
 Meantime is rack'd 'twixt doubtful hope and fear.
 A letter comes: But what are the contents?
 His pardon or his death is there conceal'd.
 Who can describe his feelings then!
 Suspense is painful, 'till it is disclos'd:
 If death, all hopes are lost;—
 If life, 'tis liberty: he roves abroad,
 And joy takes place of wretchedness and woe.
 To many now God's word's a sealed book,
 Wherein our future state is plainly shewn.
 Do we regard it? or regard it not?
 Here lies the question—
 If we regard it not—should it prove true—
 What is the consequence to us, as sinners?
 We've broke God's holy laws, and stand condemn'd:
 Yet pardon's freely giv'n, if ask'd aright.
 Does his word bear a pardon or a doom
 For my immortal soul. Each has a soul!
 And here we're all concern'd.
 And shall we trifle here?
 Forbid it Heaven! O let us act like men
 Who hope for heaven through a Saviour's death,
 And fight the fight of Faith 'gainst all opposers.

ARGUMENT SECOND:—FROM THE EVIDENCE OF OUR SENSES.

Some, there are, who, in many instances, are not satisfied without ocular demonstration; and the question generally asked by such persons is, How does it appear to our senses. Ask any person this plain question—whether highly educated or not—Does not the sun appear to your senses to move? and they will naturally answer, yes; and if we had not been told otherwise, we should have believed it did.

But it has been argued, that when Joshua said to the sun, “stand thou still,” he said it in compliance with the common idea which the people entertained of it. But he spoke to the sun, not to

the people. And if he did speak to the sun and moon in the particular manner in which we read he addressed them, in compliance with the common ideas of the spectators, what can we think of him as a leader and *guide* of the people of Israel, confirming them in a capital error in the face of the Almighty, and with such an astonishing miracle before his eyes. Should he not have undeceived them. Besides, Joshua was a type of Christ, both in his office, as a leader of God's chosen people into the promised land, and in his very name, Joshua, which signifies Jesus. He was a man who, when many of the people were looking after strange things, and strange Gods, remained faithful; and said unto them, "If it seem evil unto you to serve the Lord, choose ye this day whom ye will serve; but as for me, and my house, we will serve the Lord." He was one of the only two of all the people that came out of Egypt, who entered the promised land. Moses himself was not permitted: and can we suppose that a man so highly favoured could be deceived in this case. The miracle itself proves the reverse; otherwise it could have been no miracle at all. Is it probable that he would deceive, dissemble, or equivocate with others? Reason will not allow us to think so. This quibble is akin to that of the Jews, who were not impudent enough to *deny* the miracles of Christ, but found out a way of their own to explain the power by

which he performed them, and said he did them by the power of Beelzebub.

Now we have no sensation of the motion of the earth, if it does move, although it moves so rapidly, at least 900 miles an hour, (some say a thousand,) exclusive of its journey round the sun every year. Our senses have nothing to do with it: we are to believe it on report. This is enough to stagger weak minds. If it did move, I think we should feel the effects of it in some way or other. It must move with or without the atmosphere. If without it, how is it that a hawk can remain hovering perpendicularly over a bird which it intends to make its prey, for five minutes, which may be the case, and the bird on the ground, which, if the earth moved without the atmosphere, must be removed a distance of seventy-five miles in the five minutes, not be carried with the earth away from the hawk; for we know that the hawk could not possibly fly so far by scarcely moving its wings. Besides, should we not see some effects of motion by the resistance of the atmosphere, which is as a fluid, against projections on the surface of the earth, such as trees, hills, buildings, and the like? If we allow the idea of the earth moving without the atmosphere, (as some imagine it does,) then we may presume, that if a person were to ascend by a balloon, into the atmosphere, and remain there about four hours, with the help of a north wind to

carry him a little southward, while the earth is passing round at the rate of nearly a thousand miles an hour, from *west* to *east*, he would see America brought round to that part of space where he ascended; and he would also see the vast Atlantic pass under him, and might alight on the shores of the new world: for four hours is nearly as 4000 miles. This would be a far better way of travelling than Bishop Wilkins' scheme of sailing a ship under water to avoid storms; or, indeed, of going by shipping at all; and would serve as an excellent substitute for a telegraph, or mail.

You will say, then, that the atmosphere moves with the earth; let it be so; one or the other it must be. If this be the case, that the atmosphere moves with the earth, then, there must be an extremity to that motion somewhere, and the farther off, the swifter the motion must be. If near, would it not affect the clouds? If you say it is beyond these, I ask, where is the extremity of this motion to be fixed? Is it *one* mile, one hundred, one thousand, or one million? It is all conjecture.

It is quite ridiculous to suppose that the atmosphere moves; because it is part of the immensity of space, and therefore cannot move. For example: if a mariner were to sail a ship *westward*, on a voyage round the world, and continue in a right line, in the beginning of the voyage he would sail from *east* to *west*; but when he came to the other side of

the globe, he would sail from *west* to *east*: yet those parts of space which we call *east* and *west*, would remain just where they were, although it might not seem so to him. Or, if the north pole-star were to be removed to that part of space which the south pole-star occupies, and the south pole-star where the north is, the north star would only become a south star, and the south a north star; but those parts of space which they occupied before would be precisely the same: they could not be removed; for what we call north, would be north still, and the south, south. So that no part of space can reasonably be conceived to move from its appointed place: for if the earth were to be annihilated, that part of space where it originally was, would remain. It was there before the earth was created, and would be there if the earth were to be abolished; and there remain for ever. These are some of the inconceivables attending the other system.

Again, if the earth moves, I would ask the reason why the north star does not appear to diminish to us, in proportion to the distance that we are removed from it. If it be a fixed star, does it attend us in our march, and so is fixed to that particular distance from us that we always see it in the same place, and apparently at the same distance, let us be where we may? Or, must we suppose it fixed in that part of the heavens where we see it, so as not to move at all; and, that we travel round the sun,

so that in six months we may be more than twice as far from it as we are from the sun? Now, the sun which is said to be a *million times larger than the earth*, diminishes to the apparent size of *nine or ten inches* in diameter; yet, notwithstanding the amazing *extra* distance at which we are placed from this star, (being twice the distance that we are from the sun, together with the sun's diameter, which, added together, amounts to 190900000 miles,) it does not appear to diminish; but can always be seen of the same size, and apparently at the same distance.

There are none of *those* difficulties if we suppose the sun to go round the earth, according to my hypothesis; but all appears, at least, to me, plain and clear, and easily comprehended. Error is full of ambiguities; but truth, in most cases, is plain and intelligible. Truth is consistent; but error is not.

Again, is it not strange that our senses should be deceived in regard to the motions of the planets, and in nothing else? This is too much like legerdemain. Can we think the Almighty would deceive the senses which he has so kindly given us? In what other respect are they deceived? If we look at a *man*, we see him *as a man*; if we look at a *tree*, we see it *as a tree*; if we look at the sun, or moon, we see them as such; and why should we think we are deceived, when they appear to move from the *east* to the *west*; whereas, if they move from *west* to *east*, our senses certainly are deceived; and I

know of no other instance, in nature, wherein we are deceived in the same manner.

ARGUMENT THIRD:—FROM EXPERIENCE.

There has been the experience of many ages in favor of the motion of the sun; and not until within a century or two, for aught I know, has the contrary opinion gained any credit. But it is no unusual thing for error to spread: it is a weed that grows apace without much culture. Heathenism, Mahometanism, and Infidelity, have gained millions of patrons and advocates; therefore it is no wonder that any other error should flourish. Truth has always had the fewest votaries; but yet, truth is truth still, and must in the end prevail, whatever opposition it meets with.

Although the ancients had not the advantages of telescopes, and other astronomical instruments, of modern invention, which the present age is in possession of, yet, it is to them that we owe the main principles of the art: we only improve (if we may call it improvement) on what they have first laid down, as laws, and rules, by which they could calculate eclipses, and other phenomena, as well as modern astronomers, though they differed from the present system; and we know in some cases, contrary causes produce similar effects. For instance, if I move a lighted candle round a ball, it will enlighten it all round; and if we hold the candle

still, and turn the ball round, the effect will be the same. The causes are contrary; but the effect the same. So it is in respect to the sun going round the earth, or the earth turning to receive the light of the sun. But the question is, which is the cause; as the effect is just the same?

ARGUMENT FOURTH:—FROM REASON.

Can we reasonably believe Count Buffon, (the author of Natural History,) who, according to the account which he gives of himself, spent a great part of his life in writing, when he says, in his "Theory of the Earth," that, "The world is not what it originally was; for it was once part of the sun, and was struck out of it by a comet!"

Or, either, can we believe Plato, who was a great philosopher, and much esteemed. He tells us, that after six and thirty thousand years, the world would be in the same state as it was then; that he should be alive, and write such a book again; and, that the reader would be in the same apparel, and the same age he was then in.

Another writer informs us, that "The celestial bodies are the eleven heavens and spheres. The eleventh heaven is the habitation of God and his angels—The tenth heaven, the first mover—The ninth, the crystalline heaven—The eighth, the starry firmament—Then, the seven planets in their order; first, Saturn; second, Jupiter; third, Mars; fourth,

the Sun; fifth, Venus; sixth, Mercury; and lastly, the Moon." Then he proceeds to inform us, that "The *imperial* heaven is immoveable, most pure, immense in quantity, and clear in quality. The tenth heaven, or first mover, is also most pure, and clear, and makes its revolution in twenty-four hours; carrying with its swiftness the other heavens, violently, from east to west, *from* their own *proper* revolution, which is from west to east. The ninth, or crystalline heaven, moveth by force of the first mover; first, from east to west; then, from west to east, upon its own poles; and accomplishes its revolution in 36000 years." *

How are we to understand what he means by the tenth heaven moving violently the other heavens, *contrary* to their own *proper* motions. One would rather suppose, that the impulse given by the *first mover*, as he calls it, acting upon the other heavens, must make that motion, which they take from it, their *proper* motion. I should imagine, that no intelligent person would think such notions as these reasonable: but it certainly is *reasonable*, and *essential* too, that we, as christians, should believe the scriptures rather than such unintelligible trash, come from whom it may. Besides, astronomers disagree very materially in their calculations; as I shall prove as I proceed.

The last-quoted writer tells an odd story of

* Peachum's Complete Gentleman, 1634.

Plato's great prophecy, which is as follows:—"Two scholars, in Germany, having staid so long at an inn, had not only spent all their money, but had ran into debt about 200 dollars. They told their host of Plato's great year; and, that in that time six and thirty thousand years, the world would be as it was then; and that they should be at the same inn, and in the same chamber again; and desired him to trust them till then. Quoth their host, 'I believe it to be true; and I remember, six and thirty thousand years ago, you were here, and left just such a reckoning behind to pay; I pray you, gentlemen, discharge that first, and I will trust you for the next.'"

Many other silly notions are entertained by men "Who will be wise above what is written."

Whiston is said to assert, that the sun is hell. He foretold the destruction of the world by a comet; and yet, he lived long enough to out-live his prophecy, and find himself mistaken.

Others say, and attempt to prove, that the volcanoes are hell. "Should a wise man utter vain knowledge, and fill his belly with the east wind?" Job xviii. 2. "*Great men are not always wise.*" Job xxxii. 9.

One writer says, "The earth, in space, has no need of support, but swims indifferently with regard to sides, in the medium or pure gas, which fills apace."* It is evident that the writer, here, con-

* Wonders of Nature and Art.

siders the immensity of space to be a kind of gas, or fluid; for he says, "It fills apace:" and so indeed it must, with a *rush*, if the earth travels 68000 miles an hour; as the gas, or fluid, must then fill the whole space which the earth occupied, in six minutes.

This gas, or fluid, must be either rare or dense. If rare, or thin, how shall we account for the buoyancy, or floating of so great and ponderous a body of matter as the earth, in a rare, or thin fluid, specifically lighter than itself; for we know by experience, that whatever body floats upon a fluid substance, that body must be specifically lighter, bulk for bulk, than the fluid which supports it; as iron will float on melted lead; or wood on water.

If we say space is *dense*, and thus supports it, we shall fare no better; for then it would be like a ship, making her way through the ocean at a rapid rate, and the faster she goes the swifter the current of water runs at both sides of her, towards the wake, or track behind her, in order to fill up the space she occupied just before; and if a small boat, or other floating body, detached from her, were in the current by her side, would that boat, or body, keep pace with her? You would say, no. This therefore, by parity of reason, must be the case with the earth. A current must be the consequence of its motion, or we can form no idea of a fluid of any kind; and how can a current, so formidable, of such magnitude and swiftness as that must of necessity be, exist, and not even

possess power sufficient to move a bird in the air, nor afford us any perception of it whatever, although, on the surface of the earth. Does not this prove the immobility of the earth.

And again, how is the earth to move at all, without a *propelling* force: and if a propelling force is required, whence does that force arise, upon natural principles? You may say attraction, or any thing else; but this is no proof, for it cannot be ascertained; neither would it answer the end, for reasons before stated: it can only be imagined.

If a balloon be filled with gas, it is specifically lighter than that part of space which is near the earth; and, consequently, will rise to that part of it which is of the same specific gravity with itself, or nearly so; but if the gas is permitted to escape, and the air is let in, it begins to descend. I conclude, therefore, that every thing which is at liberty to move in a fluid, will find out that part of it that is of an equilibrium with itself.

Suppose we consider the air to be four times rarer at seven miles distance from the earth, as it is said to be, and an opening be imagined, to admit it to the centre of the earth; would it be fair to conclude that it would increase its weight in proportion to that depth? If so, would not heavy bodies, descending towards the centre of the earth, find out their own specific gravity, or equilibrium likewise, and there rest; as it is the property of fluids to sustain whatever is specifically lighter than itself?

Allowing the air to be four times rarer at seven miles distance from the earth, than it is close to the surface,* from calculation, it appears, that fifteen pounds at the surface, on one square inch, would, at the depth of 210 miles, amount to 438400000000 pounds, to say nothing of the 3,600 miles, which is the half of the earth's diameter. Where, then, is attraction?

And with respect to gravity, what can we say of the earth, although pressed on all sides by the atmosphere, equal to 15 pounds on every inch, when a square inch of it, tapering from its surface to its centre, is so much heavier than that pressure occasioned by the atmosphere; as will appear by the following calculation, from water; and there are many much heavier materials than water in the earth. There are 282 square inches in a gallon.

Pints in a gallon, 8) 282

35—2 Say 36 inches each pint; or
one yard equal to 1 pound.

Then there are 1760 yards in a mile.

1760

3600 miles to the centre of
the earth.

1056000

5280

As the tube must be }
tapering we must } 4) 6336000
take only a fourth }

1584000 pounds in every square
inch.

* Chambers' Encyclopedia; Article *Atmosphere*.

If there are 1584000 pounds in every square inch of water in the semi-diameter of the earth, and only fifteen pounds of atmospheric pressure on it, how are we to account for its remaining in its present position upon natural principles, and the laws, or rather ideas, which we have of gravity, being as they are. For a heavy ball, surrounded on all sides by a substance so much lighter than itself, to be supported by that substance? If the atmospheric pressure extends to the *centre* of the earth, in the same proportion as above the surface, then the earth may be supported by that pressure, which is said to increase four-fold every seven miles: and if this be the case, that the atmospheric pressure reaches to the centre of the earth, I cannot conceive how the earth can possibly move with such an extraordinary pressure in every direction. Therefore it does not appear that either attraction, or gravitation, will solve the difficulty; but, that it is like all the other works of the Almighty, from the largest to the smallest, “past finding out,” by all the art of man, however wise.

Thou boasting atom, Man! Of lofty mind,
To scan and contemplate the loftier heavens!
To calculate the stars, their distance tell!
That thinks to ascertain the cause
Of motion, in the spheres that pass around us,
So far above the reach of all thy art,
Come, view this insect! Is it too small
For nat’ral eyes? Then bring thy microscope:
Canst see it now? Yes; but much distorted!
But there is life, canst see that too?
And how that principle does animate the whole?
How it procures its food? And how digests it?
A thousand wonders more evade thy ken!

There's bounds to thy aspiring mind, vain Man ;
 Though like the raging sea,
 Which also has its bounds,
 That hitherto it comes, but yet, no further !
 Canst thou, then think t' explain the works of God !
 To account by natural means for all
 His wond'rous works !
 The smallest of them all will pose thy skill,
 And swallow up thy thoughts
 In its immensity !
 Cease, then, and guided by his word, confine
 Thy views within prescribed bounds,
 Set thee by wisdom infinite :
 Such knowledge must be safe ;
 And quite enough for us.
 Do not attempt to pass beyond this bound :
 'Tis fathomless ! 'Tis deep as hell below !
 As high as heaven above !
 Thy puny arm can never reach it there.

The sun, according to my hypothesis, travels 3,600 miles an hour ; but the earth, if in motion, travels 68,000 ; so that the motion of the earth is swifter than that of the sun, at the distance at which I suppose it to be, by 64,400 miles an hour ; and yet, as I shall prove, the lesser sun at the lesser distance, is equal, in all respects, to the greater sun at the greater distance. Which then, is most reasonable ? But reason alone is insufficient to trace out the works of God. "Canst thou by searching find out God ? canst thou find out the Almighty unto perfection ? It is as high as heaven ; what canst thou do ? deeper than hell ; what canst thou know ? The measure thereof is longer than the earth, and broader than the sea. Vain man would be wise, though born like a wild ass's colt." Job. xi. 7, 8, 9, 12.

Some find fault with the translation of the scriptures, and so evade the sense. But this is a very dangerous idea for any person to entertain ; for

when this is the case, they may soon be tempted to disbelieve the whole, or at least, to doubt its authenticity, and disregard it. The greatest care was taken when it was translated into the English language. Fifty-four learned men were appointed to the task by royal authority, (though only forty-seven lived to finish it,) who were, in all probability, as well acquainted with the original language, out of which it was translated, as any of our learned men in the present day, and as faithful: and after they had completed their separate parts, or allotments, the whole was attentively revised: which, I think, ought to satisfy every reasonable person.

Some cavil with scripture, because it mentions stars falling from heaven; and no wonder, if stars are 366000 times larger than the sun! but our Saviour tells us in Matthew xxiv. 29, "that the stars *shall* fall from heaven, and the powers of the heavens shall be shaken."

ARGUMENT FIFTH.—FROM FACTS.

We know that the sun, in the height of summer, rises and sets considerably behind us in England; so that if we suppose a right line, struck from sunrise to sun-set, and another line parallel to it, where we stand, we shall find them considerably apart. The sun, we know, is never perpendicularly over our heads; notwithstanding, owing to its sloping

direction, and our situation on the globe, it rises and sets very considerably behind us. As this is well known, it is equally clear, therefore, that the sun must shine, or which is the same, the course of the sun must extend, farther than from one tropic to the other, both north-ward and south-ward; although both ancients and moderns settle its course between the tropic of cancer, and the tropic of capricorn. This is an universal error, for it is evident that the sun cannot be seen in any part of the earth until it rises above the horizon: and it cannot reach the horizon of either of the poles, without passing the tropics. It appears to me, that unless its course extended beyond the poles, it would be impossible for the inhabitants of either pole to see it at all, throughout the year; because it would never be above their horizon, as is shewn in Plate 1. fig. 2; but we know, as a fact, that they see the sun the whole twenty-four hours of the day, and that for a great while together; and the remaining part of the year, not at all.

Again, we know that the light of the sun goes quite round the moon every month; the first appearance, or that of a new moon, we have on the right-hand side to us; and the light gradually increases, until it has covered the face of the moon, and then decreases towards our left-hand side, and there falls. The moon according to my hypothesis, goes from north to south, backward and forward, about

twelve times in a year, by a winding motion like that of the sun, but not to so great an extent, northward or southward. The sun goes from south to north, and back again, once in a year; making 365 turns round the earth in that time, or one revolution a day. The moon makes about 29 turns round the earth each weekly month, in all about 380 turns in the year; for, although it goes round the earth every day, yet, losing near an hour out of twenty-four, it will require fifteen turns, or thereabout, more than 365; which, added to 15, is 380.

The moon must, therefore, sometimes be before the sun to us, sometimes behind, sometimes on one side, and sometimes on the other, in its course, as it passes to and fro; and so the light of the sun is continually going round it, once a month.

To exemplify, or explain this, let a small round ball be suspended by a string: hold it at a little distance from you; then take a lighted candle in the other hand, and place it at some distance beyond the ball: you will then see no light on it; but as you pass the candle round towards your right hand, you will perceive the light on the edge of the ball, in the same shape, and in the same manner, as we see the new moon; and as the candle is held either a little higher, or lower, and as the light proceeds round the ball, it produces all the phenomena of the light of the sun upon the moon, from its first appear-

ance to its decline. So that the light of the sun may be considered as always shining on the moon, in some part or other, (eclipses excepted) as the candle does on the ball, though not visible to us; as all the inhabitants of the earth have the light of it in their turn; for when one part has a full moon, the opposite part has none.

It is a notorious fact that astronomers disagree very considerably in their calculations, which the following account will evince, and which will shew what degree of confidence we ought to place in their assertions, with all their knowledge of trigonometry, and the like. I have selected a few, out of the many which I could advance, if necessary, of their computations, as a specimen of their inaccuracy.

I can hardly believe that planets grow larger in course of time; and yet, they must grow very fast, for all the astronomers to be correct.

About one hundred and seventy-five years ago, Vincent Wing published his "*Logistica Astronomica*," wherein he gives the diameters of the following planets, viz:

"Jupiter $1\frac{1}{4}$ times smaller than the earth.

Mars 150 times smaller than the earth.

Venus 157 times smaller than the earth.

Mercury 2800 times smaller than the earth."

Now, some modern astronomers say as follows:—
Jupiter is 89,170 miles in diameter; so that, ac-

According to them, he is more than *twelve* times larger than the earth : thus,

$$\begin{array}{r}
 7200 \text{ earth's diameter.} \\
 12 \\
 \hline
 86400 \\
 \\
 89170 \text{ diameter of Jupiter.} \\
 86400 \text{ twelve diameters of the earth.} \\
 \hline
 2770 \text{ over.}
 \end{array}$$

And in Pinnock's "Guide to Knowledge" we find Jupiter reckoned more than a *thousand* times larger than the earth. Thus, we see, that in 175 years, allowing both astronomers to be *correct*, this planet alone must have *grown*, (at least, in computation) the amazing quantity of one thousand times the size of this earth !!

Mars is said to be 4,189 miles in diameter.

$$\begin{array}{r}
 7200 \text{ earth's diameter.} \\
 4189 \text{ diameter of Mars.} \\
 \hline
 3011
 \end{array}$$

Thus we find, that Mars is more than half the size of the earth.

Venus 7,687 miles in diameter.

$$\begin{array}{r}
 7687 \text{ diameter of Venus.} \\
 7200 \text{ earth's diameter.} \\
 \hline
 487 \text{ miles larger than the earth.}
 \end{array}$$

Mercury 3,224 miles in diameter.

The earth is	7200
	3224 diameter of Mercury.
	3976 less.

Therefore, Mercury, by them, is said to be nearly half as large as the earth.

What an astonishing difference we find in the above computations, of ancient and modern astronomers. First, Jupiter, by Vincent Wing, is said to be $1\frac{1}{2}$ times *smaller* than the earth; while, as before mentioned, the astronomers of the present day say, that he is *more than a thousand times larger* than the earth. Again, Mars, by Wing, is reckoned 150 times *smaller* than the earth; and we are now told he is *more than half* the size of the earth. Venus, by the modern astronomers, is said to be 487 miles *larger* than the earth; and Vincent Wing says it is 157 times *smaller*. And Mercury, by the moderns, is computed at nearly *half* the size of the earth; while Wing says he is 2,800 times smaller.

How can we reconcile these accounts to our reason? Which are we to believe? Shall we try them, as Daniel did the elders, in the story of Susannah. When their testimony disagreed, and when they were interrogated as to what kind of tree it was under? one said that it was one kind of tree, and the other said it was another kind: and accordingly both were convicted, and put to death, as false witnesses. If

we shew more favor to one than another, it should certainly be to that which appears the most reasonable, and natural, but not at the expence of revealed truth; for, "if they speak not according to that word, it is because there is no light in them."

Vincent Wing says, "Saturn contains the earth almost twice." Moderns say he is 79,000 miles in diameter. Again, moderns say that Jupiter is more than a thousand times larger than the earth: consequently, he must be more than *sixty thousand* times larger than the moon, which is said to be sixty times less than the earth. How does this agree with scripture? We read that "God made two *great* lights: the *greater* light to rule the day, and the *lesser* light to rule the night: He made the *stars* also." Here is, first, a distinction made between the two *great* lights; one is called the greater, and the other the lesser light, (and in this all agree, that the sun is larger than the moon;) but, yet, *both* are called *great* lights. There is also another distinction made between them and the stars, which naturally infers that the stars are still lesser lights. But either this is false, or our astronomers are wrong. Now we take the *moon* to be one of the "Two *great* lights." But if what our astronomers say is true, the moon is, instead of being a "great light," a very small light, if compared to jupiter, or saturn.

Is this, also, which is contrary to our senses, in compliance with our ignorance? How are we to

get instruction at this rate, that we may know right from wrong? If we taught our children in this way, would they not be likely to remain ignorant from generation to generation?

I have shewn how these astronomers disagree among themselves; is it, then, any wonder that they do not agree with the scriptures. And now I hope, I may be allowed to say that I have cut off the giant's head with his own sword; and if the head be off, the carcase, or cause, must of necessity perish.

Having finished what I intended saying in the five preceding arguments, I shall next proceed with an hypothesis, in which I do not wish to advance any thing, further than agrees with scripture—our senses—experience—reason—and known facts; and, I intend, in as plain a manner as possible, to shew how I conceive it may be arranged, to accord with all these tests, in a way which appears to me rational, as well as intelligible; so that any person, who possesses good common-sense, may understand what is my meaning; and which would, I think, answer every purpose required, if properly matured, as well as any other hypotheses, all of which differ so much from most, or all these methods of proof; and which, also, I shall endeavour to explain, by drawings, and descriptions, to prove, as clearly as I can, what I understand to be the probable truth, agreeably to the principles premised.

Some astronomers assert that it is a law in nature, or, of motion, that a body which moves round another, must necessarily move over its centre in a right line. This I deny. At the same time, they allow that the moon moves round the earth, which of itself clearly proves the falsity of the argument. The moon goes from us by its screw-like motion round the earth, southward, until it is full, or nearly so; and as it wanes, it approaches towards us again, (but this returning sometimes happens a day or two before the full,) and when it reaches its extremity northward, it changes its course towards the south, or is the new moon.

When the moon is at its extremity southward, (at harvest time, or about September, or October) and is about to return towards the north, it remains twice as long in that quarter as in any other part of its course, (as is shewn, Plate 2, fig. 1.) except at the northern turn, where it also doubles. This will account for the harvest-moon, as the sun is then considerably more northward than the moon, and therefore, shines full on its face, and of course, longer than usual.

Plate 2. fig. 1. shews by the initials of the months of the year, how the sun approaches towards us from winter to summer, or, from December to June; and how it recedes from June to December again; and likewise accounts for the equal length of the solstitial days, both in summer and winter, for, having to

return, in the same manner as the moon, it doubles the same space at each extremity of its course, and consequently, remains longer in almost the same direction to us, which is not the case in any other part of its course. This also shews the reason of the excessive heat in June and July; which is in consequence of the sun's remaining longer in its northern extremity, at the turn of the days, or the return of the sun towards the south; and as heat, as well as light, is occasioned by the sun, so, the heat being continued longer in that part of its course, it increases in proportion. The return from the south has the same effect on the cold in the shortest days, in winter, and the cold increases in proportion; thus demonstrating the adage, "as the days lengthen, the cold strengthens."

The solstice is generally accounted for by refraction, which is uncertain; and if the above plan is allowed, there is no need of referring to refraction; for as I have shewn fig. 1. Plate 1. we cannot see the sun till it rises above the horizon.

And, if the sun did not exceed the tropics in its course, it could not rise and set behind us, which we know it does in June and July, because our situation on the globe is farther northward than the tropic of cancer. There is, then, no need of refraction to account for it, as both sight and reason will prove it.

As I shall have occasion to mention the instru-

ments which I used for my calculations, it may be necessary to give a description of them, and their use, before I proceed further, that I may be better understood.

The first instrument I shall describe, is for taking the diameters of the sun and moon: and all that is required for this, is a straight rod of four feet length, with a small projection, made of brass, or iron, a very little more than half an inch wide, and three parts of an inch in length, screwed to one end, so that it may be removed. (See Plate 4. fig. 5.) This projection at the end of the rod, of half an inch, will cover the apparent diameter of the sun, when the other end of the rod is applied to the eye to view: and, as circles of all sizes agree in their proportions in the same manner as triangles, so, half an inch, in this case, bears the same proportion in the small circle, as 157 miles do in the large circle, or that which the sun may be said to describe in his course.

To measure the moon, unscrew the projection at the top of the rod, and affix another of five-eighths of an inch in width; which, by placing the rod to the eye as before, will be found to be equal to the moon's diameter. Consider the eye to be the centre of a circle whose diameter is twice the length of the rod, or eight feet, which, to find the circumference, multiplied by 3, is 24 feet; in proportion, then, as five eighths of an inch is to this circumference, so is

the same proportion to the orbit of the moon, at a given distance.

The following is a description of an instrument for measuring the course of the sun and moon round the earth, and their progress towards either pole. This is a staff five or six feet long, to fix in the ground, with a socket, or ferrule at the other end, or top of it, with a screw in the side of it to fasten a plug which it is meant to receive, and where it may be required to be fastened. This plug has two small iron rods, each two feet long, of large wire affixed to it, which are moveable at the end next to the socket. (See Plate 4. fig. 6.) One rod has a single, and the other a double joint; each rod has projections like the other instrument, described before, but only half the breadth, as the rods are only half the length of the other.

To use this instrument, level it in the same manner as you would a gun, fix it exactly with the diameter of the object, say the sun, remembering to use the single-joint rod for this purpose, as the double-joint rod will be wanted to adapt it to the place where the object is at the time you have fixed to calculate from: suppose an hour; then calculate from an hour; and when the hour is exactly expended, and you have set the double-jointed rod to the diameter of the object, without at all moving the other rod, you will see how many quarters of an inch, and one-24ths it has passed in that time,

which is just so many diameters of the object. The distance between the ends of the rods, if measuring the sun, will be seven inches, making twenty-four diameters of the sun in an hour: thus—

24 $\frac{1}{4}$ inches is 6 inches.
 24 equal parts of an inch is . 1 inch.

7

As the sun passes twenty-four times its own diameter in an hour, that number multiplied by twenty-four will shew how many diameters is passed in a day.

24
24
96
48
576

If the calculation be required for the progressive motion of the sun towards the poles, as it advances only one-half of its diameter each day, it will be necessary, in order to be more correct, to suffer the instrument to remain in the same position, two or three days before the other rod is placed to ascertain its progress. But as the moon makes a much faster progress towards the poles than the sun, a less proportion of time will serve the purpose. This operation of measuring the motion of the sun

from either pole, is more likely to be correct if done in the summer.

The distance of the sun from the earth, as ascertained by Plate 3. is four semidiameters of the earth from the centre, and three from the surface. Geography teaches that there are 360 degrees in the circumference of the earth, and every degree contains sixty miles. The following calculation will shew the number of miles which the sun must pass to agree with the geographical dimensions of the earth at the distance prescribed in Plate 3.

360 degrees.

60 miles.

3) 21600 circumference.

2) 7200 diameter.

3600 semidiameter.

3

10800—3 semidiameters; or distance of the sun from
3600 the surface of the earth.

14400—4 semidiameters; or distance from the centre.

2

28800 diameter of the sun's orbit.

3

86400—2 circumference of the sun's orbit.

4114 one-7th of the diameter, as three diame-
ters is exceeded in the circumference by
90516 one-7th.

Suns each hour 24) 90516 (3771

72

185

168

171

168

36

24

12

Hours in a day 24) 3771 (157 miles, sun's diameter.

24

137

120

171

168

3

Again,

157 miles, sun's diameter.

24 diameters each hour.

628

314

3768 miles passed in an hour.

24 hours in a day.

15072

7536

90432

90516

90432

84

H

Thus, comparing the two calculations together, it appears that there are only 84 miles difference, or about half a sun's diameter in a day; which agrees, but with this trifling difference, with the distance the sun is placed at in this theory.

A year is, according to the *tropical* or *solar* computation, completed in, or composed of, 365 days, 5 hours, 48 minutes, and 48 seconds; and the subjoined calculation will shew how near we approximate to that time, allowing twenty-four sun's diameters of 157 miles in an hour. The circumference of the orbit which this makes, is 90,516 miles, as before stated.

Sun's diameter 157)90516(576 sun's diameters each day.

$$\begin{array}{r}
 785 \\
 \hline
 1201 \\
 1099 \\
 \hline
 1026 \\
 942 \\
 \hline
 \end{array}$$

84 miles, or rather more than half
a sun over in a day.

Half a sun a day will bring 182 whole suns in a year, and one over. Now, as there are 24 sun's diameters passed in an hour, 182 must be divided by 24, the product of which will be, seven hours in a year more than 365 days, as follows:—

2)365 days in a year, or half suns.

182-1 whole suns.

$$\begin{array}{r}
 \text{Suns an hour } 24) 182(7 \text{ hours in a year; or, in the whole,} \\
 \quad \quad \quad 168 \quad \quad \quad 365 \text{ days } 7 \text{ hours.} \\
 \hline
 \quad \quad \quad 14 \\
 \hline
 \end{array}$$

Having shewn how many diameters of his own the sun passes in an hour, and the circumference of his orbit by geography, and by his own diameter of 157 miles, worked from the geographical computation, in two ways, I shall now proceed to shew by the instrument, the rods of which are two feet long; the proportion of the circle which that instrument makes to that which I have before given, as ascertained by geography, thus—

$$\begin{array}{r}
 2 \text{ feet.} \\
 2 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 4 \text{ diameter.} \\
 3 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 12 \text{ circumference in feet.} \\
 12 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 144 \text{ inches.} \\
 4 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 576 \frac{1}{4} \text{ inches; or } \frac{1}{4} \text{ of an inch the } 576\text{th part of a circle} \\
 \hline
 \text{whose circumference is } 144 \text{ inches.}
 \end{array}$$

I have before said that the sun passes 24 times his own diameter in an hour; as a kind of proof of which, I subjoin the following:—

Divide 576 by 24, (for the hours in a day,) and

the product of 24 will be the number of suns an hour, thus—

$$\begin{array}{r} 24) 576 (24 \\ \underline{48} \end{array}$$

96

96

...

Now if we divide 90,516 by 576, the product will be 157, the size which I estimate the diameter of the sun to be; and which proves that 157 miles is the 576th part of the circumference of the sun's orbit, at the distance of 14,400 miles from the centre of the earth, in the same manner as one-fourth of an inch is the 576th part of the circumference of the orbit which the instrument makes; which instrument brings one-fourth of an inch, at two feet distance from the eye, or four semidiameters of six inches each, to be, in proportion, equal to 157 miles, at four semidiameters of the earth distant, in the geographical circumference, or 14,400 miles, as follows :

$$\begin{array}{r} 576) 90516 (157 \\ \underline{576} \end{array}$$

3291

2880

4116

4032

84

The sun's course forward and backward, is found by the instrument, to be one half its diameter each day, or 78 miles.

2) 365 days in a year.

Days in half a year $\frac{365}{2}$ —1, or half a day.

2) 157 diameter of the sun.

$\frac{157}{2}$ —1, half a diameter each day.

182 days.

78 miles, half a sun's diameter.

1456

1274

14196

39 half a day.

14235

7200 diameter of the earth.

2) 7035

$\frac{7035}{2}$ —1, miles for each pole.

78) 3517 (45 days' sun shine for each pole,
312 and, in returning, twice 45.

397

390

7

$$\begin{array}{r}
 45 \text{ days.} \\
 2 \\
 \hline
 7) 90 \\
 \hline
 4) 12-6 \\
 \hline
 3-6
 \end{array}$$

According to this calculation, the inhabitants at each pole would have three months' and six days' continual sun shine, or summer months. And by this calculation, the opinion respecting the sun's approaches towards either pole, which is said never to exceed the tropics, is, to my mind, clearly nullified; for, as is shewn Plate 1. fig. 2. if the sun did not, in its course, exceed the tropics, the inhabitants of the poles could never see it at all.

Doctor Halley observes, "that the solstitial day, under the pole, is as hot as under the equinoctial, when the sun is in the zenith; in regard, all the twenty-four hours of that day, under the pole, the sun-beams are inclined to the horizon in an angle of $23\frac{1}{2}$ degrees; whereas, under the equinoctial, though the sun becomes vertical, yet he shines no more than twelve hours, and is twelve hours absent." *

In Plate 2. fig. 1., the distance of the sun's reach beyond the poles is one semidiameter of the earth, or 3,600 miles. The distance which the preceding calculation gives, is, 3,517 miles; leaving 83 miles

* Chambers' Encyclopedia.—Article *Pole*.

difference; which is only a trifle more than half a sun's diameter.

As according to my hypothesis, the sun cannot be seen in any part of the globe till it rises above the horizon, it may be seen by Plate 3. that the sun is one hour rising from an horizontal line drawn from the centre of the earth to an horizontal line, parallel to it, from the surface, or horizon; consequently, exactly at the equinoctial, the inhabitants can have no more than ten hours' sun-shine in a day; but, at a certain distance from the equinoctial, they may have twelve. At the equinoctial there are twelve hours' *day light*; that is to say, there is *day light* one hour before the sun rises, and one hour after he sets; but the sun is not visible to them but *ten* hours; and consequently, there can be no more than ten hours' sun-shine.

It may not be amiss to introduce here some kind of comparison of the quantity of sun-shine on three different parts of the globe, for a whole year. To begin with the equator.

$$\begin{array}{r}
 365 \text{ days in a year.} \\
 10 \text{ hours' sun-shine.} \\
 \hline
 \text{Hours in a day 24) } 3650 \text{ (152 whole days.} \\
 \underline{24} \\
 125 \\
 \underline{120} \\
 50 \\
 \underline{48} \\
 2 \text{ hours.}
 \end{array}$$

Days in a week 7)152 whole days.

$$\begin{array}{r} \text{Weeks in a month } 4)21-5 \\ \hline 5-1 \\ \hline \end{array}$$

Thus we see that, at the *equator*, there are five months', one week, five days', and two hours' sun-shine in the course of a year.

The quantity of sun-shine in a whole year at the *poles*, I have already shewn; which is, three months and six days.

As *we* have about seventeen hours' sun-shine in summer, and eight in winter, I shall first find the average, and calculate therefrom.

$$\begin{array}{r} 17 \\ 8 \\ \hline 2)25 \\ \hline 12-1 \text{ average sun-shine.} \end{array}$$

$$\begin{array}{r} 365 \\ 12 \\ \hline 24)4380)182 \text{ half days.} \\ 24 \\ \hline 198 \\ 192 \\ \hline 60 \\ 48 \\ \hline 12 \end{array}$$

Days in a week 7(182

Weeks in a month 4)26 weeks.

6—2

Thus we find that, of the three calculations I have here given, we have the most sun-shine, namely, six months, two weeks, and six hours.

It must be remembered that, in none of the calculations which I have here made, I pretend to shew *accurate* measurement, but only simply to shew the analogy and probability of the matter in hand; and, I think their near affinity to geographical measurement, is a sufficient warrant to ensure their acceptance as rational and probable.

It will appear from the following calculation, taking the distance at 95,000,000 miles, and the diameter at 900,000 miles, that the sun, placed at a distance of 10,800 miles, and 157 miles in diameter, will afford the earth, not only an equal quantity of light and heat, but even more than it would if placed at the former distance, and of the former size; it would appear *larger*, and, therefore, more than answer every purpose connected with it: and by the diminishing scale, given in the work, where the different sun's are compared, according to size and distance, it is proved, not only that the smaller sun is larger, in proportion, than the other, but, as is noticed in another calculation, that the

larger sun, large as it is said to be, is not large enough, (if it moved round the earth, as the Scriptures plainly affirm to be the case,* and measured by twenty-four diameters of its own, to be passed in an hour,) to complete its orbit in twenty-four hours; and, consequently, astronomers have calculated the *sun* too small, or the *distance* too great: but according to the system I have advanced, the revolution is exactly completed in the twenty-four hours, as before explained. The reason for assigning twenty-four diameters of the sun to be passed by the sun in an hour, I have also shewn, and of which any person may easily satisfy themselves, by what has been advanced.

95000000 distance of the sun.

3600 semidiameter of the earth.

95003600

2

190007200 diameter of the sun's orbit.

3

570021600

27143885 one-7th of the diameter.

597165485 circumference of the sun's orbit.

We find by the above, that the circumference of the sun's orbit at 95,000,000 miles' distance from the

* "The sun also *ariseeth*, and the sun *goeth down*, and *hasteth* to the place whence he *arose*."—ECCLESIASTES c. 1. v. 5.

surface of the earth, or 95,003,600 from the centre, is 597,165,485 miles.

Now, to prove how far the diameter of the sun (if twenty-four are passed in an hour) of 900,000 miles, and the product multiplied by twenty-four, agrees with this circumference, I give the following:

$$\begin{array}{r}
 900000 \\
 \text{24 diameters per hour.} \\
 \hline
 3600000 \\
 1800000 \\
 \hline
 21600000 \\
 \text{24 hours in a day.} \\
 \hline
 86400000 \\
 43200000 \\
 \hline
 518400000 \text{ sun's orbit by 24 diameters.} \\
 \hline
 597165485 \text{ orbit of the sun by distance.} \\
 518400000 \text{ orbit of the sun by 24 diameters an} \\
 \hline
 \text{hour.} \\
 78765485
 \end{array}$$

Thus we find that the distance of 95,000,000 miles is too great for twenty-four diameters of 900,000 miles, multiplied by twenty-four (for the hours in a day) to complete the orbit, in case the sun moved, by 78,765,485 miles, allowing twenty-four diameters to be passed in an hour.

This number, multiplied by 365, will shew the deficiency, in this case, in the course of a year, thus :

$$\begin{array}{r}
 78765485 \\
 365 \\
 \hline
 393827425 \\
 472592910 \\
 236296455 \\
 \hline
 28749402025
 \end{array}$$

Divide this 28,749,402,025, by 900,000, and the product will be the number of sun's diameters deficient in a year; that is, there will be so many sun's diameters required as the product amounts to, to make up the circumference of the orbit produced by the calculation of 95,000,000 miles' distance for the sun.

$$\begin{array}{r}
 9|00000)287494(02025 \\
 \hline
 31943(702025
 \end{array}$$

This calculation brings out 31,943 diameters of the sun deficient in a year. And as there are 576 sun's diameters passed in a day, at 24 each hour, 31,943 must be divided by 576, which will shew how many days there would be deficient in a year.

$$\begin{array}{r}
 576(31943(55 \\
 2880 \\
 \hline
 3143 \\
 2880 \\
 \hline
 263 \\
 \hline
 \end{array}$$

The remainder of this last calculation is nearly equal to half a day; consequently, there are 55 days and a half deficient in the course of a year; or, that the sun, at 900,000 miles in diameter, and passing twenty-four times that diameter in an hour, would not complete the year by 55 days and a half!

The following is a calculation, shewing the further difference, (allowing the sun to be in motion) if the sun, as some say, is to be estimated at 800,000 miles in diameter.

The circumference of the orbit which is brought out by calculating from 95,000,000 miles' distance, is 597,165,485 miles. And, by multiplying 800,000 by 24, and the product of that number by 24 again, we find the orbit which that also makes: thus—

$$\begin{array}{r}
 800000 \\
 24 \text{ diameters per hour.} \\
 \hline
 3200000 \\
 1600000 \\
 \hline
 19200000 \\
 24 \text{ hours in a day.} \\
 \hline
 76800000 \\
 38400000 \\
 \hline
 460800000 \\
 \hline
 597165485 \text{ sun's orbit by distance.} \\
 460800000 \text{ sun's orbit by 24 diameters} \\
 \hline
 136365485 \text{ per hour.}
 \end{array}$$

136365485

365 days in a year.

681827425

818192910

409096455

49773402025

This number, 49,773,402,025, as was the case with the preceding calculation of 900,000 miles, sun's diameter, must be divided by the diameter of the sun, 800,000, to ascertain how many diameters there are deficient in a year.

8|00000)497734(02025

62216(602025

By this we find that there are 62,216 diameters of the sun deficient at 800,000 miles diameter; and by the calculation from 900,000 miles diameter, we had 31,943 diameters deficient in the year!

Now, as before said, as there are 576 diameters of the sun passed by the sun in a day, 62,216 must be divided by 576, which will shew how many days there would be deficient in a year, computing the diameter of the sun at 800,000, and placed at the distance of 95,000,000 miles.

576)62216(108

576

4616

4608

8

Thus we see that there are 108 days deficient in the course of a year; that is, the sun would not accomplish his revolution, which should be complete in a year, in less than *one year and one hundred-and-eight days!!*

I have previously given a calculation, bringing by a remainder of eighty-four miles, seven hours in a year more than 365 days; and I give the following to shew how the year itself is completed, by allowing 576 diameters of the sun, at 157 miles each, to be passed in a day: and, also, to shew the agreement that exists between this calculation, and that by which the circumference of the orbit of the sun is proved to be 90,516 miles, placing the sun at three semidiameters of the earth from the surface. The first of the following calculations shews the number of miles which the sun travels in a year, calculating from 576 diameters of 157 miles each, to be passed in a day.

$$\begin{array}{r}
 576 \text{ suns per day.} \\
 157 \text{ diameter of the sun.} \\
 \hline
 4032 \\
 2880 \\
 576 \\
 \hline
 90432 \\
 365 \text{ days in a year.} \\
 \hline
 452160 \\
 542592 \\
 271296 \\
 \hline
 33007680
 \end{array}$$

This second calculation shews the number of miles which the sun travels in a year, multiplying the daily orbit of the sun—namely 90,516 miles—by 365, for the days in a year.

90516 daily orbit of the sun.

365

452580
543096
271548

33038340

33038340 number of miles per year by sun's diameter.
33007680 by daily orbit.

30660

Sun's diameter 157) 30660 (195 suns over in a year.

157

1496
1413

830
785

45

576 suns per day.

195 suns over per year.

381

Thus we find that the difference between these calculations is only eight hours in the course of a year, which, added to the seven hours before-mentioned, makes 365 days 15 hours. Now, as there are 365 days, and nearly seven hours in a year, we subtract that number from the 365 days, 15 hours, which leaves eight hours. Consequently, we see that the calculations which I have made, bringing the diameter of the sun at 157 miles—its distance 10,800 miles, and 576 diameters passed in a day, is correct, but with the difference of a few hours in a whole year. But I do not pretend to absolute accuracy.

By observing Plate 1. fig. 3. the reader will perceive that half any given distance, will reduce any object to half its apparent size. The following diminishing scales shew upon this principle, the comparative sizes of the greater and lesser suns.

LARGER SUN.	
Parts	2)95000000 distance.
$\frac{1}{2}$	2)47500000
$\frac{1}{4}$	2)23750000
$\frac{1}{8}$	2)11875000
$\frac{1}{16}$	2)5937500
$\frac{1}{32}$	2)2968750
$\frac{1}{64}$	2)1484375

Parts	
$\frac{1}{64}$	 2) 1484375
$\frac{1}{128}$	 2) 742187—1
$\frac{1}{256}$	 2) 371093—1
$\frac{1}{512}$	 2) 185546—1
$\frac{1}{1024}$	 2) 92773
$\frac{1}{2048}$	 2) 46386—1
$\frac{1}{4096}$	 2) 23193
$\frac{1}{8192}$	 11596—1

Ten thousand eight hundred miles is the distance of the smaller sun. The larger is here brought to the same distance, or as near as is needful for the purpose of comparing them together, namely, 11,596 miles.

	LARGER SUN.
Parts	2) 900000 size in diameter.
$\frac{1}{2}$	 2) 450000
$\frac{1}{4}$	 2) 225000
$\frac{1}{8}$	 2) 112500
$\frac{1}{16}$	 2) 56250
$\frac{1}{32}$	 2) 28125
$\frac{1}{64}$	 2) 14062—1
$\frac{1}{128}$	 2) 7031

Parts	
$\frac{1}{128}$	2) 7031
$\frac{1}{256}$	2) 3515—1
$\frac{1}{512}$	2) 1757—1
$\frac{1}{1024}$	2) 878—1
$\frac{1}{2048}$	2) 439
$\frac{1}{4096}$	2) 219—1
$\frac{1}{8192}$	2) 109—1

By the same number of divisions as above, the diameter of 900,000 miles at 11,596 miles' distance, appears by this diminishing scale 109 miles; and the size of the smaller sun at nearly the same distance, is 157 miles in diameter, as by the calculation before-mentioned.

It will be seen that the numbers in the above scale do not exactly agree with the size and distance of the smaller sun; nor can they easily be made precisely to agree with them: however, I think they are brought sufficiently near to shew that, as I have said before, the smaller sun, at the lesser distance, is more than equal to the larger sun at the greater distance; for, in the first of these calculations, (from the distance of the sun,) that of the large sun is brought to be 11,596 miles, and that of the smaller 10,800; leaving a difference of 796

miles in the distance; but the difference between 109 and 157, as regards size, is, to my mind, of much greater proportion, and consequently, brings out the smaller sun considerably larger, in proportion, than the larger one.

As a kind of proof of the correctness of the principle of the diminishing scale, I give the following calculation, which, although, in consequence of the remainder, not agreeing *exactly* with the above, will serve for comparison.

$$\begin{array}{r}
 8192)900000(109 \\
 \underline{8192} \\
 80800 \\
 \underline{73728} \\
 7072
 \end{array}$$

The following scale is intended to shew the principle upon which the sun appears to diminish to our sight; the size of which does not appear more than seven inches, or seven inches and a half.

SMALLER SUN.

2)157 miles, diameter of the sun.

$$\begin{array}{r}
 \underline{2)78-1} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r}
 \underline{2)39} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r}
 \underline{2)19-1} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r}
 \underline{2)9-1} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r}
 \underline{2)4-1} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r} 2) 4-1 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 2 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 1 \text{ mile; or } 1760 \text{ yards.} \\ \hline \end{array}$$

$$\begin{array}{r} 2) 880 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 440 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 1760 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 220 \\ \hline \end{array}$$

$$\begin{array}{r} 880 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 110 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 55 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 27-1 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 13-1 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 6-1 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 3 \text{ yards, or } 9 \text{ feet.} \\ \hline \end{array}$$

$$\begin{array}{r} 2) 4-1 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 9 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 2-6 \text{ inches.} \\ \hline \end{array}$$

$$\begin{array}{r} 4-1 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 1-3 \\ \hline \end{array}$$

$$\begin{array}{r} 7\frac{1}{2} \text{ inches.} \\ \hline \end{array}$$

If the sun, at 157 miles in diameter, appears too small to please some, let them try the following whimsical experiment:—Imagine your head to be the earth, (and it will bear the comparison tolerably well, for it certainly is animated earth;) the blood, and moisture, the water; the hair, the trees and vegetables; the prominencies, mountains; the eyes,

the property of receiving light ; and the sensation of heat like the rays of the sun. Let the size of the head be estimated, on an average, at six inches ; hold a candle partly under the face,* so that the rays of heat may be felt upon the face : Let the distance be eighteen inches, (i. e. in proportion as I estimate the distance of the sun,) and you will find sufficient light and heat to answer the comparison.

If we consider the sun to be of the nature of fire, (and it possesses two of its properties, light and heat,) it seems reasonable to suppose the necessity of a swift motion to maintain these properties : for instance, if a large wire, of a moderate length, bent at one end so as to form a handle, and heated very hot at the other, be immediately whirled about very swift, it will burn much farther than where it was first heated, and contain its heat much longer than it would without that motion. May we not therefore, reasonably suppose, if the sun be of the nature of fire, (which I do not say is the case, but only suppose it,) that it may be necessary for it to have a swift motion ; for we know the more fire is agitated by air, the brighter it burns. Hence arises the *use*, if not the *necessity* of a swift motion to be possessed by the sun ; but we cannot assign any reason for such a motion for the earth.

I do not conceive that the moon is eclipsed by the

* It is necessary that the candle should be held *under* the face, because the heat of a candle *ascends* only ; whereas the *sun's* rays diffuse light and heat in all directions.

light of the *body of the sun* alone, as others represent it to be; but from the diffusion, or expansion of the light emanating from the sun, which is always sufficient to cast a shadow, (see Plate 1. fig. 4.) as we know day-light does when the sun is not visible; and as the sun casts a very strong light beyond the boundaries of the earth, it is very probable that, by that light, the shadow of the earth may be reduced to an apex very little further off than the moon; for, in an eclipse the shadow appears of a larger size than the moon: and, as may be seen by drawing it upon a small proportionate scale, the sun, a *million* times larger than the earth, would not be large enough to reduce the shadow to an apex at the distance which the moon is from the earth, if the shadow were caused *sólely* by the light proceeding directly from the body of the sun.

To explain this, in the Newtonian system, there are three suns drawn; one the same size as the earth; one smaller than the earth; and another larger. The first is said to cast a cylindrical shadow, or a shadow of the same breadth as the earth; the next, or smallest, is said to spread the shadow, and instead of bringing it to an apex, would even eclipse the stars. This must be a very strong, and a very long shadow indeed to reach them at the immense distance at which astronomers place them, some of them being said to be 38,777,783,575,000

miles from us!! * For we know as a certainty that shadows weaken in proportion to their length. The third, or largest sun is supposed to cast a shadow upon the moon, which is brought to an apex from the body of the sun alone. This may appear a little reasonable at first sight, but I certainly think that if the light proceeded *solely* from the size of the sun, a sun considerably larger than the largest of them and placed at the same distance, would not answer the purpose: but if the shadow is supposed to be caused by the surrounding light, or the light proceeding from the diffused rays of the sun, (which is most likely,) the smaller sun, at the shorter distance, is, in this respect, fully equal to the larger sun at the greater distance. We all well know that light extends beyond the body of the sun; and therefore, to confine light to that size, or to suppose that there is no light sufficient to cast a shadow beyond that size, is ridiculous.

According to some accounts, the stars are supposed to be 366000 times larger than the sun; * and, that they act as suns to other worlds! May it not be reasonable, in connexion with this idea, to suppose that these worlds, or systems, have stars also, as well as we: and if *their* suns are 366000 times larger than *ours*, and their *stars* 366000 times larger than their *suns*, and, supposing there were system

* *Mechanics' Magazine*, vol. 9. page 171.

upon system, as Dr. Herschel imagined,† what immense stars there must be in the course of a few gradations! Or, on the other hand, supposing they were to diminish in proportion, if we still entertain the idea of system upon system, we might, in the end, hear of worlds no larger than apples!

As I have before shewn, if we consult scripture on this particular, we shall find no authority whatever to entertain such ideas.—Moses (Genesis, c. 1. v. xiv.) says, “And God said let there be lights in the firmament of the heaven, to divide the day from the night: let them be for signs and for seasons, and for days and for years.” “And God set them in the firmament of the heaven, to give *light upon the EARTH.*” (Verse xvii.) These passages of the sacred scripture plainly shew what these lights were created for;—to give light *upon the earth*—for *signs* and for *seasons*: not, as some suppose, (contrary to the word of God,) for *suns* and for *systems*—and these *ad infinitum*.

The idea of many systems reminds me of what I have read of one who supposed insects that live upon the bodies of other animals to have insects living in the same manner upon them, and so on, to infinity. These are curious thoughts, but admit of no proof.

In Pinnock’s Guide to Knowledge for 1832, page 124, we read that, “to a spectator in *Mars* the *Earth* will appear about the size of Venus, and never

† Encyclopedia Londinensis.

above forty-eight degrees from the sun; and will be, by turns, a morning and evening star to the inhabitants of MARS." And then directly we are told that, "to this planet our *Earth* and *Moon* appear like two *moons*, sometimes half or three-quarters illuminated, but never full:" but how the *earth* is metamorphosed from the appearance of a *star* to that of a *moon*, "deponent saith not." Wonderful properties!-- *Earth*, *Star*, and *Moon*, in one planet!! This corresponds very well with the idea of *stars* being *suns*. And if stars are suns, why not the *Earth* a *sun* too, as well as a *star* and a *moon*? If so, it cannot be a very bright one.—It is very easy to imagine things, but not always so easy to prove them.

Again, page 97 and 98 we read that, "Iron is rarely found in a native state, and those instances that have occurred carry with them a very peculiar degree of interest. *They are supposed to have fallen from the moon to our own planet!!*

"A large mass, reported to have fallen from the sky, was found by Professor Pallas in Siberia, on the side of a mountain containing a rich mine of magnetic iron ore, lying loose on the rock, and weighing 1680 pounds.

"A still larger mass, weighing about fifteen tons, described by Don Rubin de Celis, was seen in the district of Otumpia, in the Vice-Royalty of Peru." The Author adds, "The hypothesis of their having fallen from the moon or the atmosphere, appears to

be supported by strong analogy (!) as well as vulgar tradition." * Those who can or chuse may believe it, but it has no place in my creed.

Sir John Herschel states in a paper communicated by him to the Royal Astronomical Society, "That on the evening of the 22nd of September, 1832, he saw a whole cluster of stars of the sixteenth magnitude almost through the very centre of Biela's comet, (the one that lately approached so near the earth,) the light of which, according to Sir John, could not have passed through less than fifty thousand miles of the matter of the comet."

I should suppose that the light of this comet must have been very weak and faint; for we cannot even see an object through the blaze of a common candle. Now, if it is possible to see through comets, what are we to think of their being many hundreds of times hotter than red-hot iron; for if we cannot see through the blaze of a common candle, how is it possible to see through a body of such an amazing heat! So much for our knowledge of the nature and temperature of comets.

As the *moon* in the middle of *summer* appears the same height in the heavens as the *sun* is in the middle of *winter*, that is to say, that as it appears in a right line to us from the point of sight, it is

* There are thousands and tens of thousands of small masses of iron, which the common people call *thunderbolts*, found embedded in the chalk or maum rock in Wiltshire, and other parts; and may be frequently seen in the fields, which were never in the *moon*, or fell from the atmosphere, and which, when decomposed or rusted away, constitute ochre; and I apprehend these small masses are of the same quality as the larger masses, especially as there was an iron-mine in the same place.

clear, (in accordance with the idea that we cannot see any celestial object till it rises above the horizon) that, to afford a sufficiency of moonlight to the poles, the extent of its reach, northward and southward, must be about one-third of the distance of the sun from the earth, at the pole; (see Plate 2. fig. 1.) which line, or orbit, will cut the line from the point of sight leading to the sun at two semidiameters of the earth from the earth's surface, and will place the moon in a right line with the sun; and as no other distance will do the same, I therefore conclude *that* to be the distance of the moon.

I shall now proceed to shew the moon's daily course in its orbit, as measured by the instrument; the distance between the ends of the rods, which are two feet distance from the eye, being seven inches and a quarter, and the diameter of the moon being covered by the projections at the ends of the rods of five half-eighths of an inch.

$$\begin{array}{r}
 7\frac{1}{4} \\
 8 \\
 \hline
 58 \\
 2 \\
 \hline
 \text{Half-eighths } 5)116 \\
 \hline
 23-1 \text{ moons per hour.}
 \end{array}$$

This remaining one is equal to one-fifth of the moon's diameter, which 5th is twenty-three miles, and which must be deducted out of the number of

miles passed in an hour—this number will then be 2692.

The following is a calculation to ascertain the size of the moon's diameter, placing it at three semidiameters of the earth distant from the centre of the earth.

$$\begin{array}{r}
 3600 \text{ semidiameter of the earth.} \\
 3 \\
 \hline
 10800 \text{ distance from the centre of the earth.} \\
 2 \\
 \hline
 21600 \text{ diameter of the moon's orbit.} \\
 3 \\
 \hline
 64800 \\
 3085 \text{ one-7th of the diameter.} \\
 \hline
 67885 \text{ moon's orbit.}
 \end{array}$$

By dividing this 67,885 by 25, the hours the moon is compassing its orbit, we find the number of miles which the moon passes in an hour; and by dividing that number by the number of moon's diameters passed in an hour, we find the diameter of the moon.

$$\begin{array}{r}
 25) 67885 (2715 \text{ miles an hour.} \\
 50 \\
 \hline
 178 \\
 175 \\
 \hline
 38 \\
 25 \\
 \hline
 135 \\
 125 \\
 \hline
 10
 \end{array}$$

Now, as before said, in consequence of a fraction in the first of these calculations, this product, 2715, the number of miles passed in an hour, is reduced to 2692, which, being divided by 23, will bring out the diameter of the moon.

Moons per hour 23) 2692 (117 miles; moon's diameter.

$$\begin{array}{r}
 23 \overline{) 2692} \\
 \underline{39} \\
 23 \\
 \underline{162} \\
 161 \\
 \underline{1} \\
 0
 \end{array}$$

In measuring the range of the moon backward and forward towards the poles, by the instrument, the distance between the ends of the rods is one inch and a quarter; and the diameter of the moon at two feet distance is covered by five-eighths of an inch.

$1\frac{1}{4}$ one day's progress.

8

$\overline{10}$ eighths.

2

Half-eighths; or one moon 5) 20 half-eighths.

$\overline{4}$ moons per day.

117 miles; moon's diameter.

4 moons per day.

$\overline{468}$ one day's progress

15 days in half a month.

$\overline{2340}$

2340

468

7020 miles in 15 days:

By this calculation we see that the moon travels 7020 miles in fifteen days; and in approaching from the south to the north pole, it gains 430 miles every month, or about three diameters and three-fourths of a diameter of its own; which monthly progress of 430 miles, multiplied by six, for the number of months it is in advancing from the southern extremity of its course to the northern, or, in the other case, in receding from the north to the south, makes its total range 9,600 miles. In Plate 2. fig. 1. its distance beyond each pole is *one-third* of a semidiameter of the earth, which doubled for both poles, makes *two-thirds* of a semidiameter, or 2,400 miles; this, added to the diameter of the earth, 7,200 miles, brings out the same number as was brought out by calculating from its monthly increase of 430 miles, namely 9600, as follows:—

3) 3600 semidiameter of the earth.

1200

2

2400 two-3rds of a semidiameter.

7200 diameter of the earth.

9600 whole of moon's range in half a year.

Distance from the Pole.

Moon's diameter 117) 1200 (10 moon's diameters.

$$\begin{array}{r} 117 \\ \cdot \\ \hline 30 \\ \hline \end{array}$$

This remaining 30 is about a quarter of a moon's diameter; consequently, to ascertain how many of its own diameters the moon passes in advancing to, and receding from, either pole beyond the extremity of the earth, we must multiply that number by two.

$$\begin{array}{r} 10\frac{1}{4} \text{ moon's diameters.} \\ 2 \\ \hline \end{array}$$

$$\text{Moons per day } 4) 20\frac{1}{2}$$

5 days; or, in going and returning,
 — equal to 10 days' continual moon-
 light, but only once a year.

It is worthy of remark, that the wisdom of divine providence is very apparent in the order of the moon's course; for in winter, when the sun is southward, and consequently at the north-pole there is no sun-shine, then, the moon being at the full, is considerably more northward than in summer, and of course, the inhabitants of that part of the globe have, in some measure, the deficiency of the light of the sun made up by the advance of the moon. And in summer, the moon, at the full, is more southward, and consequently, the same advantage is experienced at the south-pole. Were not this

the case, the poles alternately, would be deprived of the light of both sun and moon at one time.

*"Vast regions, dreary, bleak, and bare!
There, on an icy mountain's height,
Seen only by the moon's pale light,
Stern Winter rears his giant form,
His robe a mist, his voice a storm;
His frown the shivering nations fly,
And, hid for half the year, in smoky caverns lie."—SCOTT.*

It may be expected that in the present scheme, I should say something about the order of the other planets, as to where they may be placed, and the like; but as I do not pretend to affix their sizes and distances, otherwise than by analogy, I leave the subject to others who may have more leisure and inclination to study niceties. If they are nearer to us than the sun, of course they must be as much smaller as their apparent magnitude and distance infer; and, if farther off, they may, notwithstanding be considered as smaller than the sun. If we place them in the same order as the Author quoted in page 43 of this work does, and conceive them to move round the earth in the same manner as the sun and moon, there will be a considerable distance between their orbits, as may be seen by the following arrangement; the sun and moon being, according to my ideas, 3,600 miles apart.

First, Saturn.—Second, Jupiter.—Third, Mars.—Fourth, the Sun.—(1,200 miles distance between.)—Fifth, Venus.—(1,200 miles between.)—Sixth, Mercury.—(1,200 miles between.)—Seventh, the Moon.

But even if they were *all* placed between the sun and moon, (and I conceive them to move in the same manner,) there would be 600 miles' space between them in their motions round the earth; and which, I think would be quite sufficient to prevent any disorder, or interference with each others' orbits; and thus they would appear in various parts of the heavens, according to their different velocities.

As to the fixed stars, as they are called, such as the constellations, I conceive to be beyond the sun; but how far, I do not pretend to determine: at the same time I do not imagine that they are at that immense distance which some suppose; otherwise they would be larger than the sun, which I deny. What I should mean by fixed stars, (agreeably with the idea of the earth's immoveability,) are such stars as are so fixed as to form constellations, and move together in their proper order. And I see no reason to suppose them to be at a much greater distance than what I have just mentioned; but when they can be proved to be all suns, as some say, then we may think 38,777,783,575,000 miles no great object!

From the foregoing pages it will appear, according to the tenor of Scripture and its obvious meaning, that when the world and all the planetary system were created, they were evidently designed for a display of the glory and almighty power of the Creator, and for the existence and benefit of mankind, and the other creatures to whom he was

pleased to give an existence:—that the whole system is so combined that none can be separated without rendering the other parts in a degree useless, if not destroying its existence:—that the whole is to remain until God has accomplished his purpose concerning mankind; and that when that purpose is fully accomplished—at the great day of account—this earth, and all the planetary system will perish together, as of no further use. For “The heavens shall pass away with a great noise, and the elements shall melt with fervent heat.” “The earth also, and all the works that are therein shall be burned up,” 2 Peter, iii. 10. There are many other passages of Scripture to the same effect, and if we are to receive the Scriptures precisely as they are revealed to us—if we are neither to add to, or diminish them at our greatest peril, let us seriously consider, and beware how we tamper with them.

Allowing the sun to be in motion, from the following calculation it will appear that, if the sun is at the distance which in this work I have ascribed to it, it will not have to travel so far in the course of a year as the earth, independent of its diurnal motion, by 566,933,088 miles.

95000000 sun's distance.

900000 ——— diameter.

95000000 ——— distance.

190900000 diameter of the earth's orbit.

190900000 diameter of the earth's orbit.

3

572700000

27271428 one-7th of a diameter.

599971428 circumference; or number of miles passed in
— a year.

The earth travels 599971428 miles.

And the sun (see page 80) 33038340

566933088

It may be necessary for me to explain more particularly than I have hitherto, what I mean by cutting off the head of the Giant, for we are now come to an issue. The *head* I compare to the earth, which is both large and heavy. And if I prove satisfactorily, that the earth is fixed, I cut it off, in respect to its motion, from the Newtonian system—the whole system is at once destroyed, and the motion of the sun undeniably established. And if it can be fairly proved that my hypothesis is not supported by Scripture, Reason, our Senses, Experience, and known Facts, it must fall likewise. But if it is, and to these tests I submit it, it cannot be confuted.

When a man is tried, convicted, and condemned by the laws of his country, he is considered as virtually dead; so I consider the Giant's head to have been cut off long since by the "Sword of the Spirit," (the word of God) but as many, like Goliath, (who

cursed David by his Gods) pay too little regard to this, I must also use the Giant's own sword, his words, (for words are swords, Psalm lxiv. 3.) which will be found both weighty and sharp enough for the purpose, if wielded only by a weaker David. And although the stone (the scripture) may have killed him, it may be necessary to cut off his head to convince those who are hard to believe; and which, if I have not already done to their satisfaction, I will give a stroke or two more, and a musket-ball besides to convince them, if possible.

It is said, a soldier's musket will carry a ball a mile, for the sake of argument, let us suppose in four seconds, and fired eastward, the direction in which the earth is said to move in its *diurnal* motion. Now this diurnal motion of the earth would carry the man who shoots the ball a mile in the same time; (for in turning 900 miles an hour, it moves a mile in four seconds;) consequently, as the ball and the man are both going in the same direction, the earth travelling at the same pace as the ball, they would both arrive at the end of the mile together, thus :—

360 degrees.	60 minutes.
60	60
24) 21600 (900 miles per hour.	Or, 4) 3600 seconds.
216	900 parts; or, four
...	seconds to a
	mile.

And if the ball went twice as swift as the man, in this case, it would not appear to the person who shot it, to go but *half a mile*! But if we try it by the *annual* motion of the earth, which is said to be 68,000 miles an hour, the earth would then pass a mile in the *nineteenth part* of a second, and although the *ball*, if shot in the same direction as the earth, be supposed to pass a mile in the same time, yet the *man* would be carried by the earth at the same pace, and to the same distance in that time! just as a man on horseback keeps pace with his horse. Now we know that in shooting a ball from a musket in the direction which the earth in its diurnal motion is said to move, the man who shoots, does *not* arrive at the end of the mile at the same time as the ball, and therefore the earth is clearly proved to be immoveable; for if any two bodies in motion start together, in one direction, and maintain an equal velocity for any time or distance, they must arrive at the place of destination together. And I hope that now I may be allowed to say that the head of the Giant is fairly cut off.

The design of this treatise is, as I said in Chap. 1st, to corroborate Scripture, which I believe to be true, and am anxious that others who may have doubts of its authenticity, (and there are many such persons in the present day,) may be convinced of the truth of it also, so that it may be a mean of strengthening the confidence of the wavering, and

confirming the faith of those who embrace its contents as their comfort and support in the present state, and summit of their hopes in the future: and that they may be able to confute gainsayers, I wish to remove what appears to me to be a very considerable obstacle to its belief—the present system of astronomy, which appears to carry demonstration with it, although directly opposed and contrary to scripture.

St. Paul, (Phillipians i. 17.) speaks of himself as being set for the defence of the gospel, and warns us against receiving any other: for, says he, “Though we, or an *Angel from heaven*, preach any other gospel to you than that which we have preached unto you, let him be accursed.” As this and other threatenings for adding to or diminishing the scriptures, are so severe as on the one hand, to “add all the plagues written therein” to him who is so bold and presumptuous as to add to them, and, on the other hand, to “take away his part out of the book of life” who shall wilfully diminish them, we should be very cautious how we handle them, so as not to contradict them. Let us not attribute the science of astronomy wholly to fallible men, who are so liable to err; but rather say with David, “Not unto us, O Lord, not unto us; but unto thy name give glory.”

With this view of the Scriptures and Astronomy, I leave the foregoing pages to the consideration and candour of all conscientious and intelligent persons.

DESCRIPTION OF THE PLATES.

PLATE I.

Figure 1. Is designed to shew, that let a person be on what part of the earth he may, it will be impossible for him to see the sun till it rises above the horizon.

A. A. A. A. Horizontal Lines.

B. B. B. B. Points of Sight.

Fig. 2.—This figure shews that unless the sun shines farther northward and southward than the tropics, as is generally believed, it would be impossible for the inhabitants of either pole to see it at all throughout the year; whereas, we know that they have its light more than three months, and for a considerable time without setting; and the other part of the year they have twilight; and if the sun reaches from one extremity of the earth to the other, and as much farther as I have endeavoured to prove, it will certainly have that effect. (See Plate 2. fig. 1.)

A. England.—B. Mid-day in summer.—C. Mid-day in winter.—D. the Earth.

Figure 3. Is the principle of the Diminishing scale; half the distance being half the size, and so on.

Figure 4. Is designed to account for the eclipse of the moon from the expanded light of the sun, and not, as some suppose, from the *body of the sun* alone.

PLATE II.

Figure 1. Represents a side view of the extent of the sun's course forward and backward, as viewed from the

east, and pointed out by the initials of the twelve months in the year; with its orbit at the different poles in summer and winter: the distance of the sun and moon from the earth, and their heights, in summer and winter, as they appear to us.

- 1.—Point of Sight.
- 2.—The *moon* as it appears to us in the middle of *winter*, where the *sun*, although at a greater distance, appears in the height of *summer*.
- 3.—The sun in the middle of winter.
- 4.—The sun in the height of summer.

Figure 2. Represents the comparative sizes of the sun and moon to the earth, with the natural eclipse of the sun.

A. Point of Sight.—B. the Moon.

PLATE III,

Is designed to point out the true distance of the sun, according to my hypothesis, and should be viewed as looking towards the south. Whatever luminous body in its course rises above the horizon, it becomes at once visible, but not before. If the sun therefore were placed nearer to us than four semidiameters of the earth from the earth's centre, it would not be seen until later than we do actually see it; and that in proportion to the distance: and to carry the idea to an extremity, if it were to roll upon the earth, we could not see it till near twelve o'clock, as may be seen by the figure. If farther off than four semidiameters, in proportion to the distance it would be higher in the heavens than we see it, which is shewn by the line G. extended from the point of sight: And if it were to rise beyond where the horizontal line and the hour line cut or meet each other, it would not make the twenty-four hours complete, and

appear as we see it; but would appear too high. Consequently, to make the twenty-four hours exact, it must be precisely at the distance from the earth before-mentioned; namely, three semidiameters from the earth's surface, or 10,800 miles.

It is also intended to shew the distance of the sun principally as connected with the hour lines, with which it must necessarily correspond, or it cannot be true to time, and be at the height we always see it at each hour of the day. If the sun were ninety-five millions of miles distant, it would be as many times higher than is represented in the outer circle in the plate, in proportion as there is difference between 50,400 and 95,000,000.

From the centre of the earth to the outer circle, or extent of the plate, are fourteen semidiameters of the earth, or 50,400 miles; but if the distance were extended to 95,000,000 miles, it would appear 1884 times higher.

50400)95000000(1884

50400

446000

403200

428000

403200

248000

201600

46409

A. The Earth.—B. Point of Sight.—C. The sun at 10,800 miles' distance.—D. Imaginary distance, to shew how

it would rise too high if placed farther off.—E. E. E. E. E. Rising lines, or where the sun would appear if placed at the greater distance.—F. F. F. True hour lines.

PLATE IV.

Figure 1. Shews the hourly course of the sun in its orbit.

Figure 2. Shews its advancing and receding course towards each pole, daily.

Figure 3. The comparative sizes of the sun and moon.

Figure 4. The sun's course at the equinox.

Figure 5. Instrument for measuring the diameter of the sun and moon.

Figure 6. Instrument for measuring their courses in their orbits, and their progressive motions towards the poles.

Figure 7. The double and single joint of the instrument.

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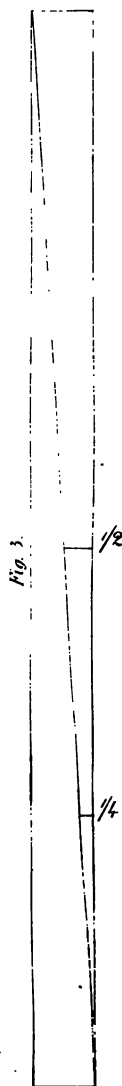
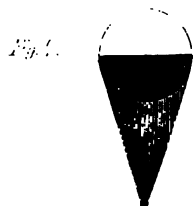
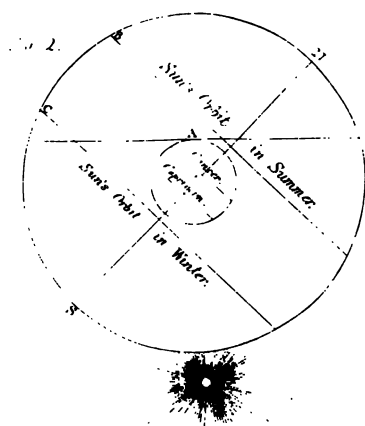
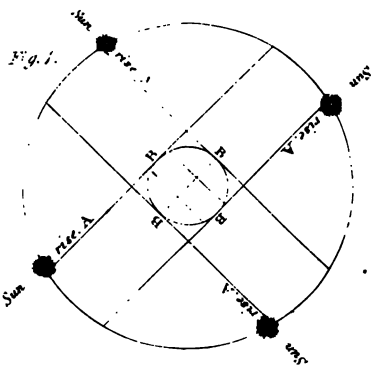
CORRIGENDA.

- Page 4. Fifteenth line from top, *for* "its," *read* "their."
6. Seventeenth line, *for* "was," *read* "were."
15. Ninth line, *for* "was," *read* "were."
15. Eleventh line, *for* "was," *read* "were."
26. Twenty-second line, insert the word "my."
50. Twenty-first line, *for* "3,600," *read* "3,768."
50. Twenty-fourth line, *for* "64,400," *read* "64,232."
64. Last line but one, *for* "is," *read* "are."
73. Fourth line from bottom, *for* "sun's," *read* "suns."

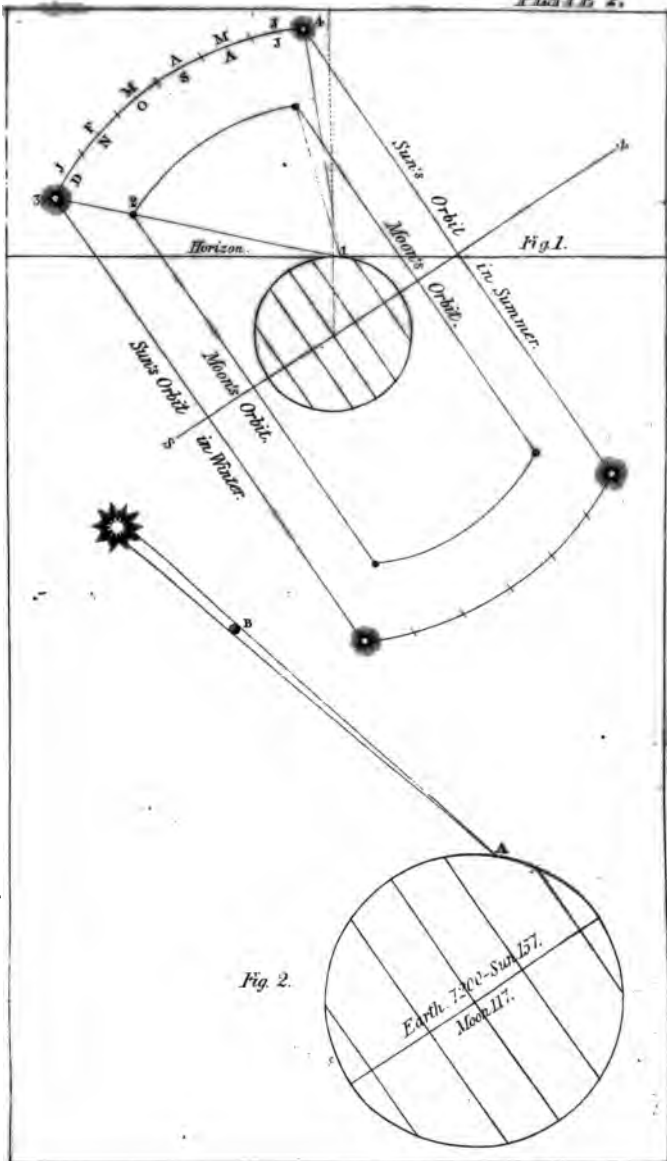
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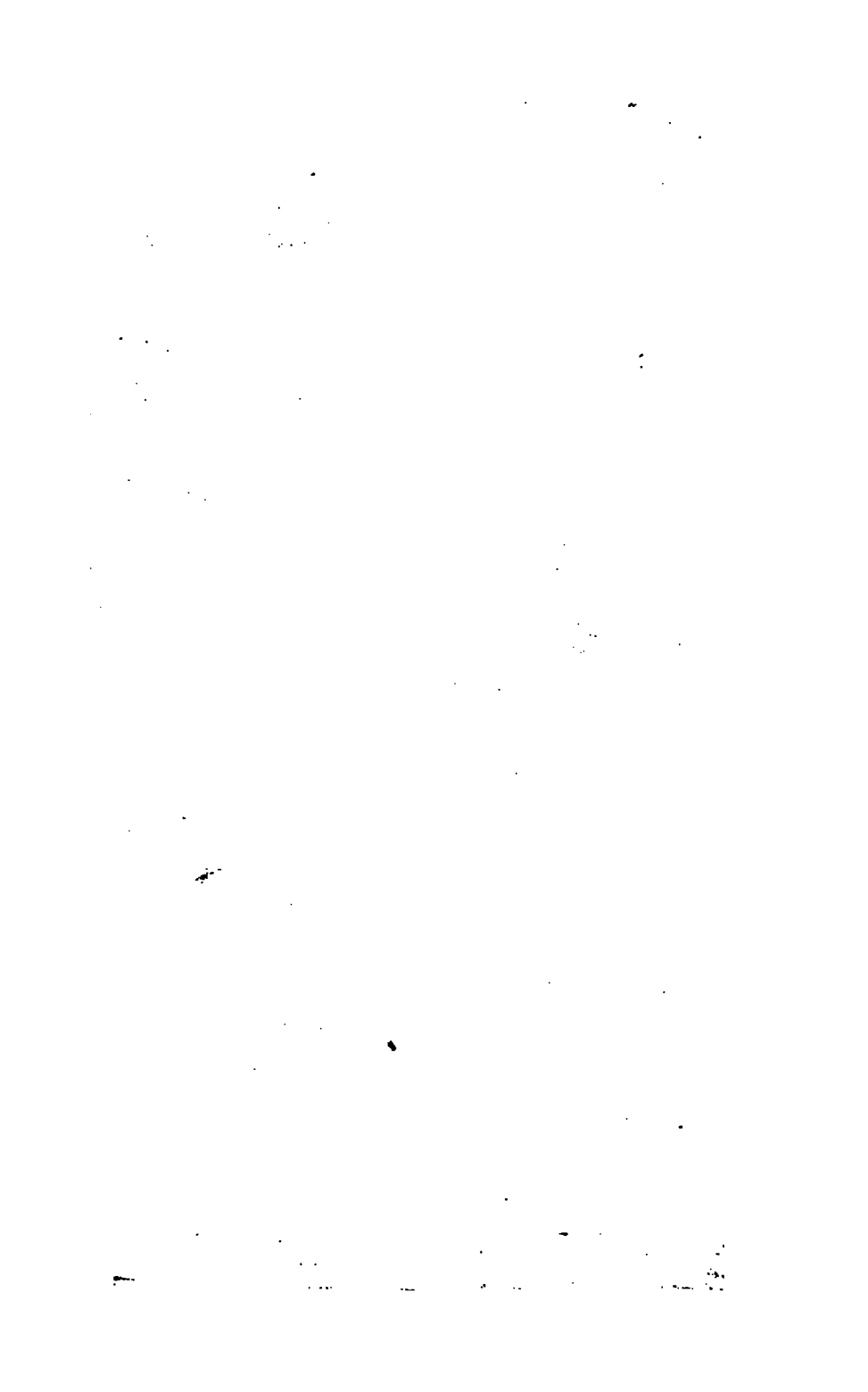
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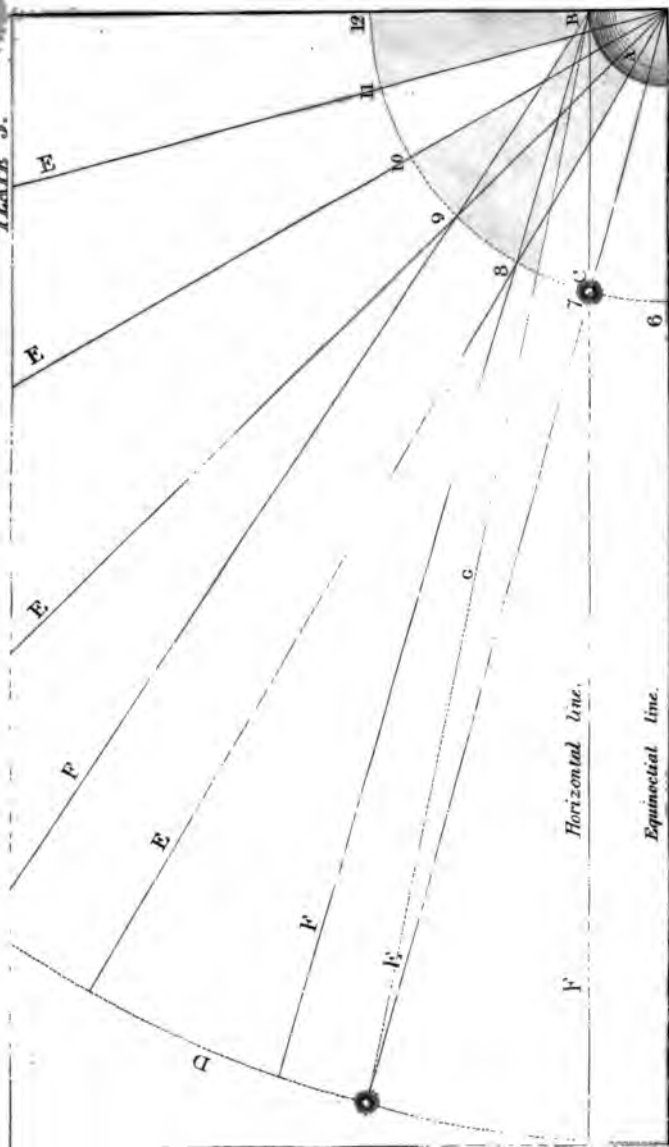
PLATE 1.





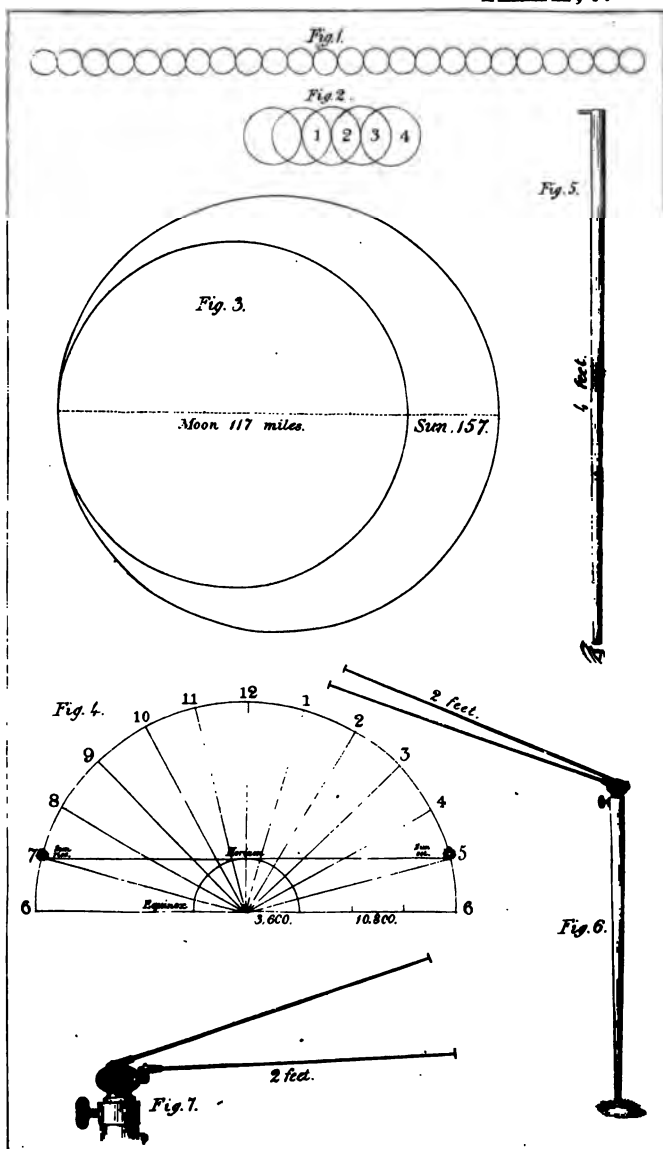








PLATE, 4.





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